

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics



Master's Thesis

**Consumption of Beer and White Wine in the Czech
Republic**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Bc. Abdalmageed Al wadhaf

Economics and Management
Economics and Management

Thesis title

Consumption of Beer and White Wine in the Czech Republic

Objectives of thesis

The aim of the diploma thesis is to determine and evaluate consumption of beer and white wine in the Czech Republic in the selected period and to detect its main determinants.

The aim will be fulfilled based on the partial aims. Then, several hypotheses will be defined and verified. Based on the results of and empirical analysis the final conclusions will be introduced.

Methodology

The diploma thesis will cover both, theoretical and empirical part. Theoretical part will contain theoretical background of the selected topic as well as the methodological framework. Scientific literature will be used to prepare the literature overview. The empirical analysis will be based mainly on the time series analysis. Other suitable methods will be employed as well. Based on the empirical analysis the results will be presented and some recommendations will be suggested.

To fulfill the aim of the thesis the selected methods and indicators of time series analysis will be employed as following:

- regression analysis (trend function)
- index analysis (base index, chain index)
- econometric model (complex relationships among selected variables)

The proposed extent of the thesis

60 – 80 pages

Keywords

Beer, white wine, consumption, time series, econometric model, Czech Republic.

Recommended information sources

FRANK, R H. – BERNANKE, B. – ANTONOVICS, K L. – HEFFETZ, O. *Principles of microeconomics*. New York: McGraw-Hill Education, 2016. ISBN 978-1-259-25410-9.

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Declaration

I declare that I have worked on my master's thesis titled "Consumption of beer and white wine in the Czech Republic" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 30/03/2022

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I would like to thank professor Lenka Rumankova for her cooperation and supervising my thesis, my parents whom I haven't seen for 8 years for their support during my work on this thesis.

Abstract

This thesis is focused on the consumption and consumer behaviour of beer and white wine in the Czech Republic for the selected period 1998-2020. The main goal of this thesis is to analyze consumption, its determinants, and the factors influencing the consumers' behaviour. In the practical part will be used the trend functions for the market analysis and two simple regressions for selected commodities in the selected period to analyze those data using MS excel and SW Gretl.

This thesis studies the consumption of beer and white wine in the Czech Republic between 1998 and 2020 years (22 observations).

The main procedure in the practical part of this thesis will be based on econometric models using the ordinary least square method, where selected variables will be studied for their impact on the consumption process of beer and white wine.

The main aim of the thesis is to evaluate the consumption and consumer behaviour of beer and white wine in the Czech Republic for the selected period, examine the determinants influencing the consumption of beer and white wine in the selected period, and discover which determinant has the stronger impact on the consumption process.

One of the variables is the price, where the low price of beer and white wine in the Czech Republic increases the consumption not even by the locals, but also by tourists and foreigners who live in the country.

Keywords: Consumption, Beer, White wine, Consumer, Behaviour, Trend, Model, OLS, Determinants

Spotřeba piva a bílého vína v České Republice

Abstrakt

Tato diplomová práce je zaměřena na spotřebu a spotřebitelské chování piva a bílého vína v České republice v období 1998-2020. Hlavním cílem této práce je analyzovat spotřebu, její determinanty a faktory ovlivňující chování spotřebitelů. V praktické části budou využity trendové funkce pro analýzu trhu a dvě jednoduché regrese pro vybrané komodity ve zvoleném období k analýze těchto dat pomocí MS excel a SW Gretl.

Tato práce studuje spotřebu piva a bílého vína v České republice v letech 1998 až 2020 (22 pozorování).

Hlavní postup v praktické části této práce je založen na ekonometrických modelech využívajících obyčejnou nejmenších čtverců, kde je u vybraných proměnných studován jejich vliv na spotřebu piva a bílého vína.

Hlavním cílem práce je zhodnotit spotřebu a spotřebitelské chování piva a bílého vína v České republice za zvolené období, prozkoumat determinanty ovlivňující spotřebu piva a bílého vína ve zvoleném období a zjistit, který determinant má silnější dopad na proces spotřeby.

Jednou z proměnných je cena, kdy nízká cena piva a bílého vína v ČR zvyšuje spotřebu nejen místních, ale i turistů a cizinců, kteří v tuzemsku žijí.

.Klíčová slova: spotřeba, pivo, bílé víno, spotřebitel, chování, model, BMNČ, determinanty

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1 Introduction

The Czech Republic has an old history of brewing beers, where the first brewery of beer in Czech was founded more than 1000 years ago exactly during the year 993 in Brevnov Monastery in Prague and later after 100 years Czech beer breweries were processed and started to grow up widely around the country.

In the thirteenth century, the first legal rules were applied. Later, nobles also wanted the right to make beer and various controversies ensued. The end of the 18th century was influenced by the teachings of the drinking master František Ondřej Poupě and his successors. They transformed fermentation into a rational productive activity. An important moment in the Czech beer industry was the founding of the Bürger brewery in Pilsen (now Braddrog) in 1842. (Ean Rail , 2020)

Czech breweries were gradually increasing the effectiveness of the industry, mostly because of the flow of international experience and technologies, the improvement of vertical coordination in the supply chain worldwide.

As well as Czech Republic's history of wine goes back to the 3rd century, even though the consumption of wine has declined in the 20th century, the last 2 decades have shown the rebirth of the wine industry in the country, and the consumption of wine was accounted to be 11% of the total alcohol beverage. (Ean Rail , 2020)

The wine market has a long tradition that cannot be defined as an innovative sector as it is based on agriculture. The problem can be related to the marketing strategy adopted by wine producers, but nowadays Czech wine market has come back to the market as a main alcoholic beverage with beer.

The beer market is one of the biggest alcoholic markets all over the world to be consumed by people, and the Czech Republic is the same case as the country is known as one of the best and cheapest beer producers with good quality and different flavors, and thus the consumption of beer in the mentioned country is relatively high compared to other alcoholic drinks even by locals, expats, or tourists.

Wines have been cultivated on the territory of the Czech Republic for more than 1700 years, though the local winemaking regions refer to the most arctic in Europe. Nowadays, the share of viniculture and winemaking in the final products of plant cultivation is about 6% in the Czech Republic, although this branch plays an important role in some areas. For

instance, over 90% of the entire areas are used for viniculture in the southern provinces of Moravia, and more than a third of territories are taken up for it.

Many studies focus on the consumer behaviour in different markets, as the consumer is the main target for any products that come to the market and based on the consumer activities and behaviour, will be decided and studied if the product will keep going and the remaining company will grow or not, in this thesis will be focused on the consumer behaviour towards beer and white in the Czech Republic using statistical data and samples then discussing the result of that.

One of the factors affecting the decline in consumption of beer is the price, but this is not the only factor. The reason, Efforts to have a healthy lifestyle, change in beer drinking habits, the transition from beer to wine, and some others also play a role. Affected by the final price of beer special taxes, as well as higher labor costs and component prices. Since 1995, the excise tax in the Czech Republic was derived from the size of the brewery production is divided into six regions (mainly in Europe). ((Monika Březinová , 2021)

2. Objectives and Methodology

- **Objectives**

Main Aim

The main goal of this diploma thesis is to evaluate the consumption and consumer behaviour of beer and white wine in the Czech Republic for the time series 1998-2020 and examine the determinants influencing the consumption of beer and white wine in the selected period.

Partial Aims

In the diploma thesis will be 2 partial goals.

- To study the impact of selected variables on the consumption process of both beer and white wine using a simple regression model to analyze those data.
- To evaluate the factors influencing the consumption of beer and white wine, and which factor or determinant has more effect on the consumption process.

Hypothesis

To fulfill the mentioned aims the following hypothesis will be employed:

1. As the average gross income increases, therefore the consumption of beer and white wine increases.
2. Consumer price of the selected commodities is influencing the consumer behaviour towards beer and white wine as consumers tend to consume more when prices are going down.

- **Methodology**

The Methodology that will be followed in this thesis is divided into theoretical and practical methodologies. The theoretical part will focus on the consumption definition, literature background, cultural, sociological, and psychological contexts of consumption as it will include an overview of the beer and wine markets globally and in the Czech Republic.

The consumer behaviour and the factors influencing consumers' behaviour and consumption determinants will be studied in this part.

The practical part will focus on the consumption of beer and white wine in the Czech Republic for 22 observations from the year 1998 till 2020 and study the change in the consumption of beer and white wine annually for the selected period. A simple regression

model will be employed to analyze the data for the selected time series where the Ordinary Least Square method (OLS) will be used to analyze two models for beer consumption and white wine consumption separately and compare the results of the two models.

The selection of the variables for the models are based on their impact on the consumption process and consumers' behaviour, and they are divided into exogenous (independent) variables and endogenous (dependent) variables, the independent variables for both models are consumer price of beer, the consumer price of white wine, and average gross income in the Czech Republic, and the dependent variable of the first model is the annual consumption of beer, while the dependent variable for the second model is the annual consumption of white wine for the selected time series.

Interpretation of the outcome of the models will focus on the impact of the increased or decreasing of the selected commodities on the consumption processes of beer and white wine.

Models verification, Model application (coefficients of elasticity) will be employed and econometric tests will be used to check the quality of the models.

The outcome of the practical part will be the results which will be discussed and to evaluate the factors influencing the consumption of beer and white wine.

3. Theoretical Part

History, development, and current state of brewing in the Czech Republic. There were 804 breweries in the Czech Republic in 1900. During the first world war, the brewing industry was impacted very negatively. Breweries had a set ration of barley which covered approximately one-quarter of what was needed. In 1916, processing barley and malt was completely banned. Brewery equipment from copper, brass, and bronze was disassembled for war purposes. Production declined to a mere 14% of the pre-war level during the war. During this time, 122 breweries closed.” (Anon., 2009)” This trend continued, and in 1918 there were 526 active breweries in Czechoslovakia. After 1918 there were no new breweries because of the difficulties in Czechoslovakia caused by the war, such as low standard of living, shortage of goods and loss of foreign markets, and destruction of machinery.” (Brezinová , 2021)”.

The crisis in the brewing industry was also caused by the changes in beer production and increased beer prices. Production was concentrated in bigger production units since 1923, so this caused another decline in the number of active breweries there were 456 in that year. This trend further continued with the beginning and course of the Second World War when there were 374 breweries in Czechoslovakia. In 1946, the Economic Group of Brewing and Malting Industry was created and later a National Company of Czechoslovakian Breweries was created, and breweries with a production volume of over 150,000 hectoliters were nationalized.” (wojtyra, 2020)” The change of the ownership structure was the beginning of an orientation towards a planned economy with the consequence of (1948) the establishment of 22 national businesses, which associated 194 active breweries at that time.” (Anon., 2014)” Central planners decided on the number of breweries and their production, as well as the amount of beer to import and export. During this time, there was almost no beer imported to Czechoslovakia. As for the type of beer, the only produced and consumed beer during this time was a lager. Lagers produced during this period were, however, more differentiated by taste and quality than they are today.” (Brezinová , 2021)”.

The transition of Czechoslovakia from socialism and planned economy to democracy and market economy, which hit Eastern Europe, also had a significant impact on the beer market in the Czech Republic and in Slovakia (both countries became independent in 1992). Breweries were privatized and later taken over by international companies such as Heineken

and SABMiller (they later joined with AB InBev, which sold their assets in the Czech Republic and the whole of Eastern Europe to the Japanese group Asahi), which dominates the Czech beer industry today.

Czech breweries were gradually increasing the effectiveness of the industry, mostly because of the influx of international know-how and technologies, improvement of vertical coordination in the supply chain, and utilizing economies of scale. Traditional local beer was replaced by homogenous beer produced by big companies. The technology of beer production was altered so that shorter production cycles could be achieved (processes

of fermentation and aging were connected). This led to the standardization of quality, which on the one hand caused the elimination of lower quality beer, but on the other hand, also lowered the differentiation of product.” (Antonín, 2005)” In 2000, the production of the entire brewing industry in the Czech Republic was 17.92 million hectoliters, in 2015 exceeded the magic number of 20 million hectoliters This trend of continuous increase continues to this day, latest official statement for 2019 states that the production volume was 21.6 million hectoliters. Although the Czech Republic, republic continues to be number one in beer consumption per capita worldwide, consumption is constantly decreasing. The highest was in 1992 with some sources claiming consumption of up to 169 liters per capita, another peak was in 2003 with consumption of 161 liters per capita The claim was made, but the decline has since continued, to 141 liters per capita in 2019.” (Kafkadesk, 2018)”

3.1. Consumption

3.1.1. What is Consumption

Consumption can be defined as the use of goods and services by consumers, and talking consumers can be humans, animals, or even machines that can consume energy for example.

3.1.2. Historical Background on Consumption

Consumption has a long history since the first life on earth consumption has been an important object for people mainly and a basic thing during daily life, purchasing a coffee, beer, or food and drinking or eating it is a consumption, animals eating grass is a consumption and laundry using electricity it is consuming energy, so consumption is an interesting topic to be focused on nowadays.

Consumption and Economy are strongly related where, by studying the consumption of a certain good it can be decided if the goodwill remains in the market and grow or not, many businesses focus on consumption as an important factor for their growth.

Consumption, in late-twentieth-century western forms of capitalism, can thus be viewed as a social and cultural process involving cultural signs and symbols, rather than simply an economic, utilitarian process. The social and cultural aspects of the process will be the primary focus here. This approach, however, is not intended to give the impression that economic factors are unimportant. Both in advanced capitalist societies and in those social formations that remain predominantly rural and agriculturally based, there are many groups whose economic situation, rather than the social and cultural factors to be discussed here, determines their consumption patterns.

Consumption became an important concept in sociology, and in social theory more generally, during the 1980s. The focus on consumption was part of a wider debate about post-modernity that is about whether or not western capitalism had undergone a significant change, so deep-rooted that it required a new theoretical orientation which was to be signaled by the term 'post-modern'. If 'modern' implied an industrial, urban, capitalist society, in which socio-economic class was still the determining feature of people's lives, of their sense of who they were, their identity, 'post-modern' implied a post-industrial, suburban, even post-capitalist social formation in which old, stable points for establishing people's sense of identity had been displaced. Identities in post-modern conditions become more flexible and float around in a state of potential, if not actual, change." (Bauman, 1992)". Consumption has been seen as epitomizing this move into post-modernity, for it implies a move away from productive work roles being central to people's lives, to their sense of identity, of who they are. In place of work roles, it is roles in various kinds of family formations, in sexual partnerships of various kinds, in leisure-time pursuits, in consumption in general, which have come to be seen as being more and more significant to people. These concerns have become reflected in sociology and social theory as a debate about whether or not western societies are moving towards becoming 'post-modern'." (Featherstone, 1991)"

3.1.3. Cultural Context of Consumption

The cultural context of consumption concerns the fundamental organization of meaning for a community. Through its meaningful distinctions, culture creates categories of person, time, space, activity, and object. It supplies the distinctions of class, sex, age,

occupation into which the social world is organized. It defines the concept of individual and corporation which inform the social organization and social action. It organizes the continua of time and space into a set of distinctions that inform what culture means by "when" and what it means by "where." It decides in short how the phenomenal world is turned from a homogeneous mass of sensation into a coherent, demonstrable, and shared body of distinct impressions.“ (Douglas et. al, 1978)“

The history of consumption worked and continues to work extraordinary changes in the culture of the West. It helped to change our cultural categories of time and space. What impressed me was the effect of fashion.“ (Braudel most, 1973)“.

3.1.4. Sociological Context of Consumption

The sociological perspective calls for an account of how consumption by individuals is influenced by group membership and how the consumption of groups is influenced by their internal dynamics and definition.“ (Mayer, 1982); (Nicosia & Mayer, 1976)“ Moreover Individual consumption is seen to be influenced by membership in families, social classes, subcultures, ethnic groups, and so on.

Lifestyles, friendship circles, occupations, and "reference" groups are all examples of "reference" groups. where membership has desired These groups, in turn, demonstrate characteristic aggregate consumption patterns based on the nature of their demographic composition, social location, resource availability base, status entitlements and ambitions, and self, society, and world concepts. The serial influence of the consumption of one group on the consumption of another has been considered in the form of diffusion theories and opinion leadership models, and these have been useful in tracking the movement of stylistic and technological innovations through society. The competition between individuals as group members has been considered through theories of conspicuous consumption.“ (Mason, 1981); (Veblen, 1912)“ .and vertical and horizontal status competition .“(Simmel, 1904)“. This is hasty and imperfect summary represents some of the considerations that arise when one attends to the sociological context of consumption.

3.1.5. Psychological Context of Consumption

Consumption history is nothing if not a study of new attitudes, new sources of information, new types of information processing, and new decision-making activities. A "presentist" view of the history of consumption would have us believe that Western

Europeans and North Americans embraced new consumption patterns quickly, enthusiastically, and effortlessly. But this is incorrect. Before we could become full-fledged consumers, fundamental shifts in the psychological context of consumption had to occur. There are many aspects to the development of this new context. As “(O’Neill, 1978)“and“ (Leach, 1984)“. point out, it was necessary first to persuade people to want. This represents not merely a change in existing attitudes but the inculcation of an entirely new attitude. An entirely new "readiness to respond" (Day 1972) had first to be created to bring individuals into the consumer society.

3.2. Beer Market

3.2.1. Global Beer Market

The global beer market was worth \$605,246.1 million in 2020, and it is expected to grow to \$816,847.7 million by 2030, with a CAGR of 2.7 percent from 2021 to 2030.“ (Anon., n.d.)“. The majority of the world's countries have seen rapid urbanization and financial improvement. This has increased people's disposable income. Furthermore, this has resulted in a shift in consumer preferences, particularly among young, aspirational drinkers in developed economies such as Europe and North America, toward different and modern beer as opposed to traditional beer and rum. Furthermore, beer is a widely consumed, produced, and traded alcohol around the world, which attracts the youth population. Furthermore, as a result of continuous innovation in taste, flavors, packaging, and other factors, the population is gradually shifting toward sophisticated, moderated, and premium beverages.

The number of breweries has increased significantly in recent years. As the number of alcoholic beverage consumers grows, so does the demand for a variety of flavors. Consumers are constantly looking for new flavors in beers to expand their beer palate. As there are many well-established global players in the market, players from countries such as the Czech Republic, Mexico, Costa Rica, Argentina, Chile, India, and the Caribbean are expanding their product portfolio to offer new products to consumers.

As the number of local players grows, so does the demand for more breweries, so market players are focusing on partnering or opening their breweries in various international markets to make their products available in those markets. The trend of consuming local beers has increased the number of breweries, which is expected to boost the beer market during the forecast period. However, alcoholic beverages have a reputation for being

addictive as well as harmful to one's health if consumed in excess. The rise in the number of consumers suffering from alcohol addiction has been a major source of concern for governments around the world. As a result, many governments have enacted strict rules and regulations governing the sale and distribution of these products. Furthermore, there are restrictions on such products' advertisements and promotions, which limits the marketing strategies available to manufacturers. Furthermore, some governments back campaigns and non-governmental organizations (NGOs) that oppose the use of such beverages. These factors are significant impediments to market growth. The beer industry has been classified according to type, packaging, category, production, and region. Lager, ale, stout & porter, malt, and other types dominate the market. The market is divided into glass, metal cans, and others based on packaging. The market is divided into three categories: popular-priced, premium, and super-premium. The market is divided into three categories based on production: microbrewery, microbrewery, and craft brewery. The market is being studied across North America, Europe, Asia-Pacific, and Latin America. (Anon., 2021)

- **Types of Beer Based on Taste**

The beer market is classified into lager, ale, stout & porter, malt, and others. The larger segment accounts for a significant portion of the beer market; however, the ale segment is expected to grow at the fastest CAGR during the beer market forecast period. Lager is one of the most popular beers in the world. Furthermore, the bottom-fermented techniques used to brew it keep lager beer fresh.

- **Types of Beer Based on Packs**

The beer market is divided into glass, metal can, and other packaging types. Glass is the market leader in terms of market share and is expected to grow at a rapid CAGR during the forecast period. Glass bottle packing will continue to be at high demand as consumers' primary choice for dependable, healthy, sustainable, and premium beer. Because glass is durable, non-porous, oxygen-impermeable, and heat tolerant, it preserves and presents beer flavor exactly as intended, and consumers prefer beer in glass bottles.

- **Types of Beer Based on Production**

The beer market is divided into three production categories: macrobrewery, microbrewery, and craft brewery. The macrobrewery segment dominated the market and is expected to maintain its dominance during the forecast period.

Anheuser-Busch InBev, Beijing Enterprises Holdings Limited, Carlsberg Group, Diageo PLC, Dogfish Head Craft Brewery, Inc, Heineken Holding NV, Squatters Pubs and Craft Beers, Sierra Nevada Brewing Co., The Boston Beer Company, Inc, and United Breweries Limited are among the key players profiled in the report.

3.2.2. Czech Beer Market

Overview of Czech Beer Market

The beer market is one of the biggest alcoholic markets all over the world to be consumed by people, and the Czech Republic is the same case as the country is known as one of the best and cheapest beer producers with good quality and different flavors, and thus the consumption of beer in the mentioned country is relatively high compared to other alcoholic drinks even by locals, expats, or tourists.

The beer market is classified as an oligopolistic market because a small number of dominant firms hold a large market share, creating significant barriers to entry. As a result, one can question the competitiveness of the beer market (An Empirical Price).

beer analysis, 2009). "(Linstead 1989) justifies the beer market's oligopolistic structure by virtue of the following characteristics A few large breweries control the majority of the production.

which results in high market concentration as a result of a series of horizontal mergers In addition, quite a high as a company acquires suppliers and retailers, it achieves a certain level of vertical integration. Customers do not have significant market power, and their product portfolios are very similar.

The competition is not interested place in terms of prices, but also in terms of advertising, promotional activity, style, and so on. Obstacles to entry barriers are high because large breweries are well-established and enjoy strong customer loyalty. Finally, Breweries often diversify into other industries, such as catering or leisure, to broaden their reach. options for strategic thinking The beer market can be defined based on product and geographic dimensions. The product market is growing.

determined by "the ease of substitution between products (beer brands) with those that are in the close substitutes in the same market and those outside the market being very imperfectly substitutable with those who are on the inside" (Swinnen, 2011). Product market substitution is affected by product characteristics such as

alcohol content and type of product. booze (lager, premium, stout, etc.). In terms of beer's geographical distribution, it is most commonly found in the United States.

The beer market has been decided to be geographically national. The most popular type of beer is more popular all over the world. Product market substitution is affected by product characteristics such as alcohol content and beer type (lager, premium, stout, etc.). In terms of beer geography, it is commonly assumed that the beer market is geographically national. Globally, the most common type of beer is larger.

3.2.3. Brands of Czech Beers

The Czech Republic has well known for producing and exporting beers worldwide, this is due to the long history of brewing beers in the country.

The quality, reliable prices of beers, and diversity of brands are other reasons for the Czech Republic being on the top of exporting and consuming beers in the whole world.

The Czech Republic has more than 70 brands of beers, even though all of them are good beers, not all of them are common worldwide. This section will be mentioned the most common beers in the Czech beer market.

- 1- Pilsner Urquell, on the top of Czech beers is Pilsner, which is referred to Plzen city in the Czech Republic, while this beer is sometimes labeled as Polish, it is now exclusively brewed in Plzen, a top Czech brewery. It was brewed in Poland and Russia for a time. However, the Czechs now have exclusive brewing rights. Josef Groll invented the world's first pilsner in 1842, and it is widely regarded as the world's first pilsner. It has an ABV of 4.4% and it is classified under the lager beers category, and it is the most popular beer of Czech beers in the world.” (Renegade, 2021)”.
- 2- Černa Horá Velen, the phrase Cerna Hora means ‘black mountain’ which comes from one of Moravia’s oldest breweries, which was opened in 1530, it contains abv of 4.8%.” (Ratebeer, 2021)”
- 3- Březnický Ležák, contains a 5.2 percent ABV and is hopped four times before being cellar-aged for six weeks. It has a rich golden color, a bready aroma, and a bitter finish in the middle. Like champagne or grodziskie, it is a geographically protected drink (from Bernice). Herold Brewery has been the sole producer since 1999.
- 4- Czechvar, has an ABV of 5% and an IBU of 22.” (Renegade, 2021)”.

- 5- Zichovec Coconut Stout, has an imperial ABV of 14.5% and is classified as a sweet beer where, 10° beers have an ABV of 3.5 percent, while 12° beers have an ABV of 4.2 percent. About the degrees, locals refer to beers as 10s or 12s. The Balling scale is used, and the higher the degree, the sweeter the beer.” (Bludice, 2021)”
- 6- Kozel Premium Lager, Kozel means ‘goat’ in Czech – which explains the hairy one on the label, it has a pale gold color and an ABV of 4.6%.” (RASV, 2017)”
- 7- Svijansk Máz, his beer, has only been around since 1998, but it has already made a name for itself. It's the brand's best-selling beer and one of Czechia's top movers. Saaz hops and hops extracts are used in the beer. It has a 4.8 percent ABV, is 11° in temperature, and is lighter than other Czech beers.” (Renegade, 2021)”
- 8- Bernard Gluten-Free Lager, Bernard Brewery has been in operation since the 1600s, but it did not begin exporting until 2009. It offers a diverse selection of beers, ranging from non-alcoholic plum brews to bohemian ale. Bernard Gluten-Free Pale Lager has a 4.9 percent ABV and a 37 IBU. Every 100ml of this beer contains 45 calories.” (S.L, 2020)”

3.3. Wine Market

3.3.1. Overview of The Global Market of Wine

Global wine production averages around 275 million hectolitres per year, with consumption of around 220 million hectolitres. In Europe, approximately 160 million hectolitres are produced annually, while approximately 130 million hectolitres are consumed. During the so-called "fertile years," the amount of wine produced is greater. In 2004, 194 million hectolitres of wine were produced in Europe. As a result, in normal years, European wine production exceeds consumption by about 20%. (It was around 49 percent in 2004.) While the number of vineyards and winemaking areas in Europe has remained constant or slightly decreased in recent years, the number of vineyards and winemaking areas outside of Europe has increased. Between 1996 and 2000, the area of vineyards increased by 31.9 percent in Asia, 19.9 percent in Oceania, 6.7 percent in America, and 4.2 percent in Africa. As a result of this expansion, wine exports from the aforementioned areas to Europe, including the Czech Republic, have increased significantly, even though Europe is the larger exporter. There are more and more globalized factors in the wine market, as well as other branches of the industry,

which means that geographical barriers are disappearing and markets from various countries are becoming more tightly integrated.

3.3.2. Czech Wine Market

Czech wine is both modern and traditional. Czech wine can be edgy, playful, and approachable at the same time as it can be elegant, elevated, and serious. Czechs consume nearly all of the wine produced in the country, so very little is exported. Czech wine is a mystery to the rest of the world, but locals know it's fantastic.

The Czech Republic is divided into two wine regions: Bohemia and Moravia. Bohemia is a region near Prague that produces only 5-10% of the country's wine. Moravia is located in the country's south-eastern corner, bordering Austria, and produces 90-95 percent of the Czech Republic's wines. When we say Czech wine, we're referring to wines from the Moravian region.

The first plantings were made in the 2nd century, and there are stories of Emperors planting grapes and giving wine as gifts for royal celebrations and sacrifices. They established extensive vineyard areas with imported grapes from France and Germany.

Since the 13th and 14th centuries, the region has grown significantly in terms of industry. Viticultural and winemaking regulations were established in 1309, and the vineyards around Mikulov and Valtice were documented, becoming the oldest preserved register of Liechtenstein vineyards.” (Ahtel, 2022)”.

3.4. Consumers' Behaviour

Consumer behaviour is a field of study, which witnesses great attention from marketers. People buy things to satisfy various needs every day and make purchase decisions that affect not only themselves but also their families, the environment, and most importantly, the businesses which they buy the goods from. Therefore, it is essential to understand the way people buy and reasons for such purchases.“ (Blythe, 2013)

Moreover, businesses should be aware of the experience consumers get from purchases, which often affects future consumer acting. Thus, building customer loyalty is another aspect that should be clearly understood by businesses and its importance goes hand in hand with understanding consumer behaviour. Consumer behaviour is a process when people “select, purchase, use or dispose of a product, services, ideas or experiences to satisfy needs and desires” (Solomon, 2013). Blackwell, Miniard & Engel (2001) define consumer behaviour as a field of study focusing on consumer activities and analyzing simply “why people buy”.

Consumers may be divided into three clusters according to the level of product consumption; heavy, moderate, and light users. The simple rule stands here, heavy users display the highest level of consumption and are known as a primary target market as most of the profits come selling to them and tend to be more loyal, which appears to be corroborated by what.“ (Geraghty, 2007)“. when researching the Irish alcohol market, found, i.e. people who consume beer more often tend to be also more loyal. Light users are quite the opposite and are likely to switch brands more often. Moderates are in the middle of these two.

3.5. Factors influencing Consumer Behaviour

Consumers are influenced by several factors, which are classified in different ways.“(Schiffman et al, 2010)“.divided influencing factors into personal, psychological, social, and other factors.

When measured by volume, beer is consistently the most consumed alcoholic beverage in the world (European Beer Guide, 2006; International Wine and Spirits Record, 2018). Considering the size of this market, the number of microbreweries that have recently appeared across the globe .“(Bentsen & Smith, 2018; Fertő, Fogarasi, Major, & Podruzsik, 2018), and their growing popularity „(Vacl, 2014).

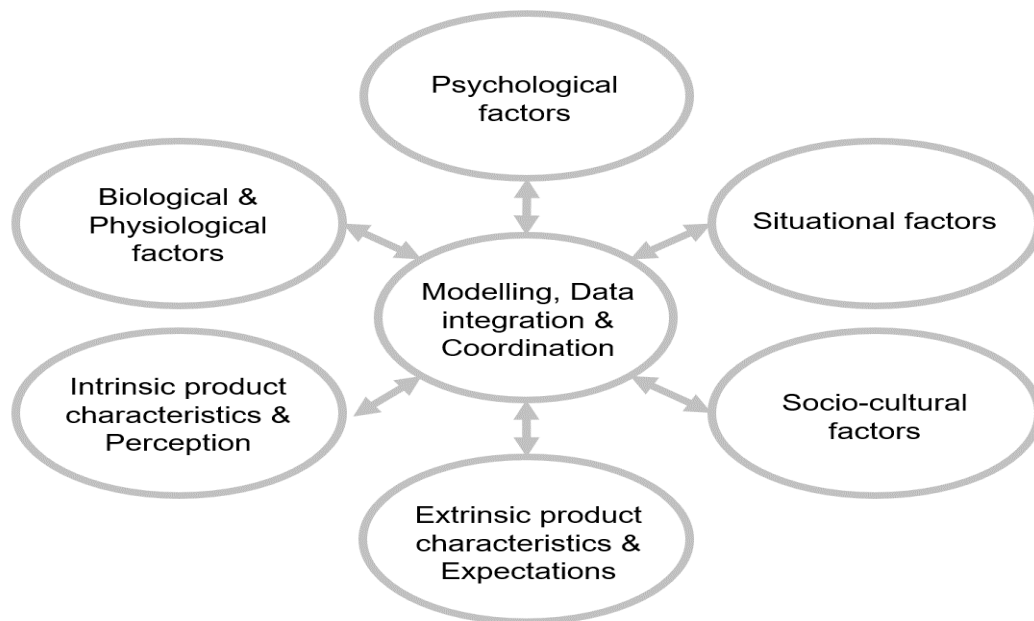


Figure 1 Factors influencing the consumers' behaviour.“(Betancur et al. 2020)

Figure 1 shows the factors which influence beer and wine consumption and consumer behaviour, and every factor impacts the consumption differently, as for example certain psychological conditions have a significant impact on the likelihood of developing alcoholism. Individuals suffering from depression, bipolar disorder, and social anxiety, for example, are much more likely to develop alcoholism.

There are other factors such as age which is an important factor, and it differs from one country to another, wherein some countries it is allowed to drink at the age of 18 and some other countries it is allowed from the age of 16.

Cultural, religious and social factors are other factors, as every society has a different culture for example middle east mostly it is not allowed to sell or consume alcohol, because, of religious and cultural reasons, social factor influences alcoholic consumption in a different way, wherein some countries and specifically talking the Czech Republic, having a beer is a normal thing or it might be sometimes the main thing in the social life.

Additionally, the last decade or two has seen several gradual, but steady, changes in consumers' drinking patterns. This is reflected, for example, in the lower consumption of alcohol in some product categories relative to what was previously the case, or a shift in preferences between types of alcoholic drinks, such as beer and wine. For example, although overall alcohol consumption decreased from 2000 to 2015 in Japan, the UK, and the USA, wine consumption has been increasing slightly while beer consumption has decreased in these countries.“ (WHO, 2000, 2015)“.This trend suggests that the decrease in beer consumption is due both to a shift towards other alcoholic beverages, and lower alcohol consumption overall.

4. Practical Part

4.1. Introduction of Analysed Markets

The brewing industry in the Czech Republic (CR) has a significant impact on the state's employment and economy. It employs approximately 65 000 people, contributes nearly CZK 30 billion (EUR 1.175 billion) to the state budget, and is an important consumer of raw materials from Czech farmers .“(Ministry of Agriculture 2015; CABM 2019a). In recent years, there has been a significant decrease in the number of restaurant customers, which has had a negative impact on the Czech economy, brewing, and employment, which cannot be offset by increasing exports abroad. To understand the root causes of this problem, it is necessary to first comprehend how consumers behave in the CR beer market.

Employment increased in the retail sector, reflecting rising off-trade consumption, but declined slightly in other sectors, with the hospitality sector experiencing the greatest decline, reflecting a decline in on-trade consumption. Nonetheless, indirect employment in this sector is significant, accounting for approximately 38,000 jobs. Over 12,800 jobs are created in supply sectors, which could be described as primary and secondary distribution, by the brewery industry, primarily in agriculture and the media and marketing sector. Breweries, on the other hand, generate 7,000 jobs. The business sector is the smallest of the sectors creating jobs in the Czech Republic. It is estimated that 5,200 jobs will be created.“
Brewing industry in Czech republic 2017)“.

Every consumer is influenced by a variety of factors, each of which can be different. To comprehend these factors, it is necessary to first identify current beer market trends as well as consumer preferences. This section will focus on the trend functions of the selected commodities for the selected time series and analyze them as determinants that influence both sides of consumer behavior, as well as the consumption of beer and white wine.

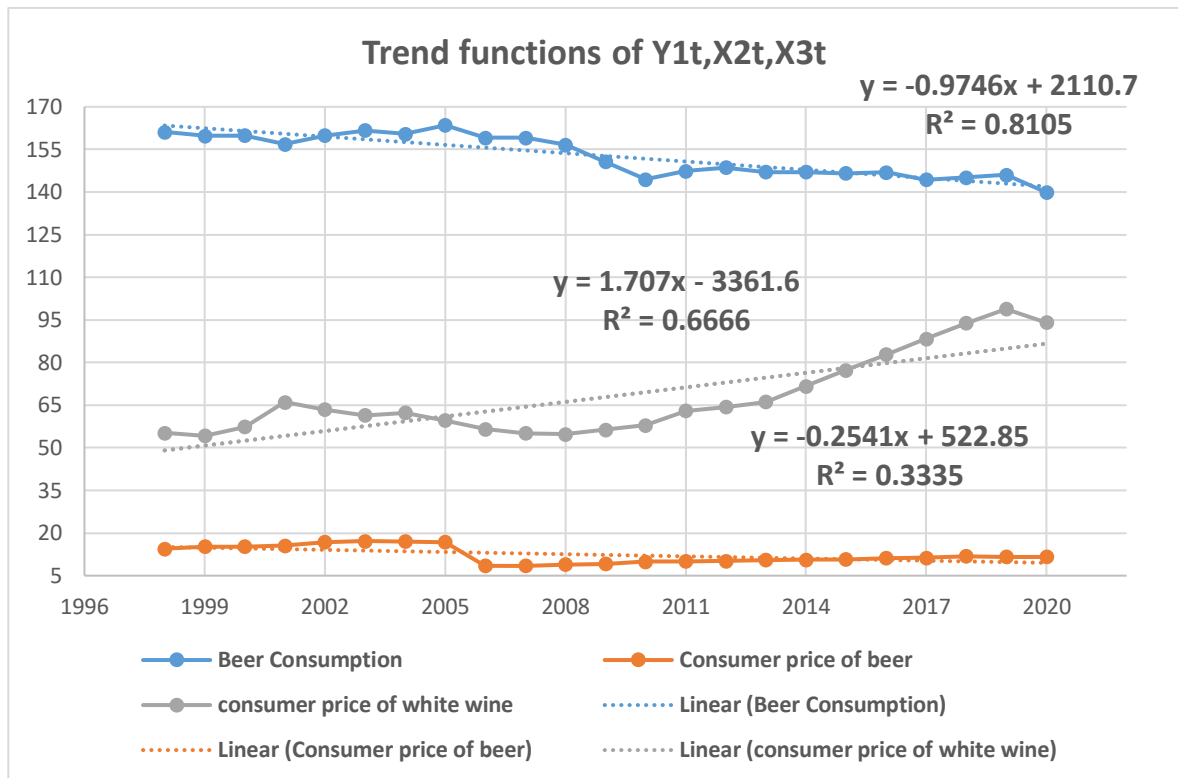


Figure 2, the trend functions for the selected time series

- From figure 2, starting from the first plot which represents the trend function of beer consumption in the selected time series (1998-2020), as it is assumed as a linear regression the trend function “ $y = -0.9746x + 2110.7$ ” shows that the consumption of beer is decreasing in the selected time series linearly as the R^2 value > 0.70 , in this case, $R^2 = 0.8105$ which means the trend function is approximately linear.
- The second trend function “ $y = 1.707x - 3361.6$ ” represents the consumer price of white wine, as shown in figure 2, the consumer price of white wine increases linearly in the selected period, the quality of regression is not perfect as it is in the previous regression, but still considered as a good regression as $R^2 = 0.6666$ which means 67% of the variables are explained by the trend function.

- The last trend function “ $y = -0.2541x + 522.85$ ” represents that the consumer price of beer decreases for the selected period, talking about the assumed regression it might not be accurate, as the value of $R^2 = 0.3335 < 0.70$, a small value which means the linear regression is not the perfect one for this data, but that does not contradict the fact the consumer price of beer was decreasing from the year 2003 almost from 17 CZK to 8 CZK till the year 2008 as it is shown in the plot, even it slightly increases by around 2 CZK in the next 12 years.

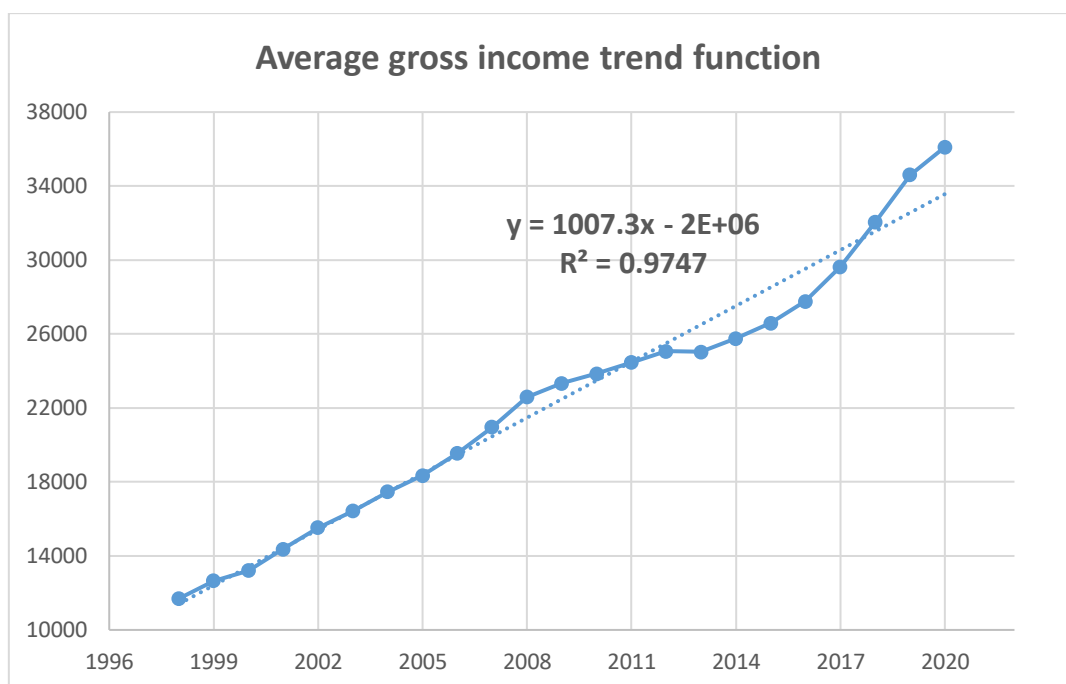


Figure 3, The trend function of average gross salary

Figure 3, shows clearly that, the average gross salary is increasing for the selected period, as is proved in the trend function “ $y = 1007.3x - 2E+06$ ” and by checking the value of $R^2 > 0.70$ which is, in this case, $R^2 = 0.9747$, very close to 1.00 meaning the regression is perfectly linear and the average gross salary increases linearly.

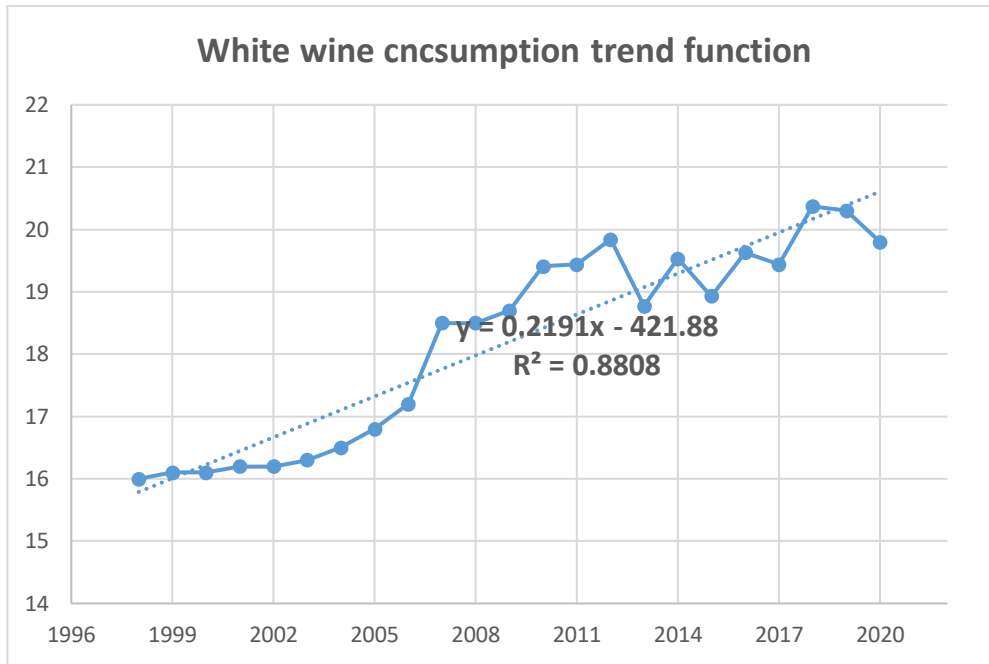


Figure 4, The white wine trend function

Figure 4, shows the trend function of white wine consumption in a linear form, where the function $y = 0.2191x - 421.88$ shows that white wine consumption is increasing for the selected period linearly and the value of $R^2 = 0.8808$ proves that the increase is linear as $R^2 > 0.7$ which means 88% of the variables are explained by the linear regression.

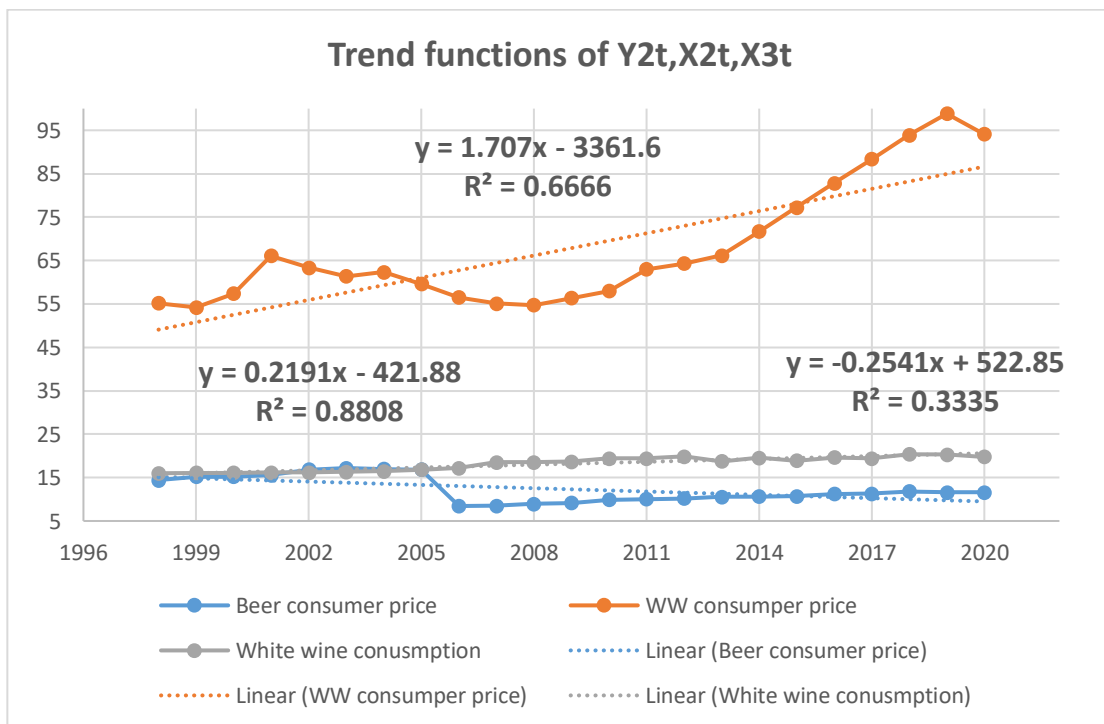


Figure 5, The trend function of white wine consumption and other selected commodities.

The main focus of figure 5 is the trend function of the consumption of white wine, as the other variables were explained previously, as shown in figure 8 the consumption of white wine is increasing for the selected period, and the trend function $y = 0.2191x - 421.88$ proves that as this increase is linear as assumed because the value of $R^2 = 0.8808 > 0.70$ which represents that almost 88.1% of the variables are explained by the selected regression.

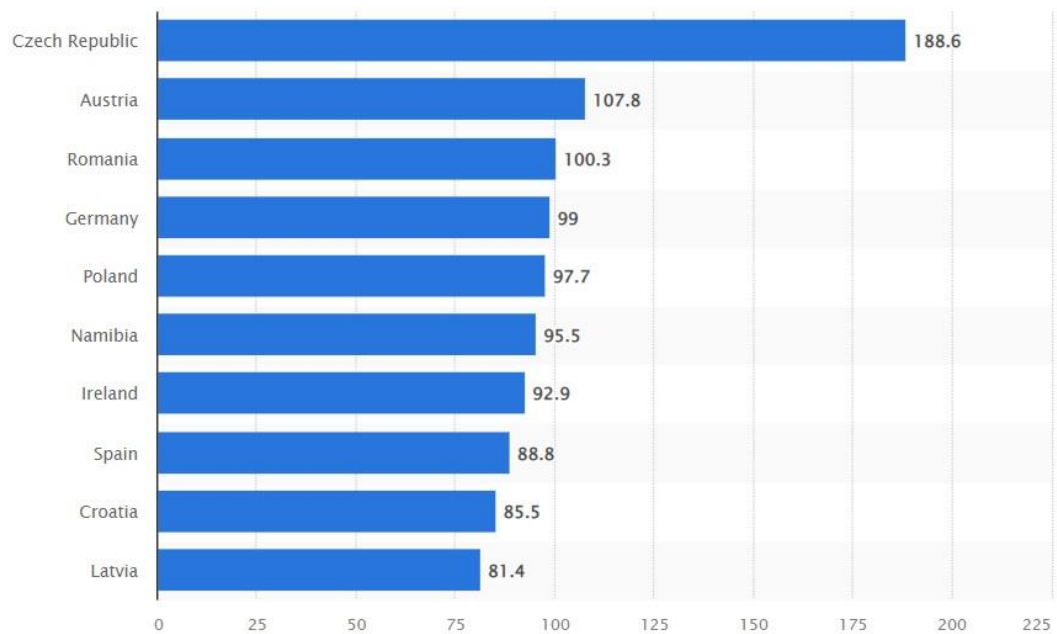


Figure 6 beer consumption by leading countries 2019 L/Capita.“(Statista 2022)

Figure 6 shows the beer Consumption in the year 2019 by leading countries. As shown in the figure, the Czech Republic is leading the world in beer consumption in the year 2019. Latvia comes number 10 among the world’s biggest consumers of beer with 81.4 L/Capita, whereas the Czech Republic exceeds Latvia by 107.1 L/capita more than double the consumed amount of beer in 2019, which is exactly the consumed amount of beer for Austria and Latvia.

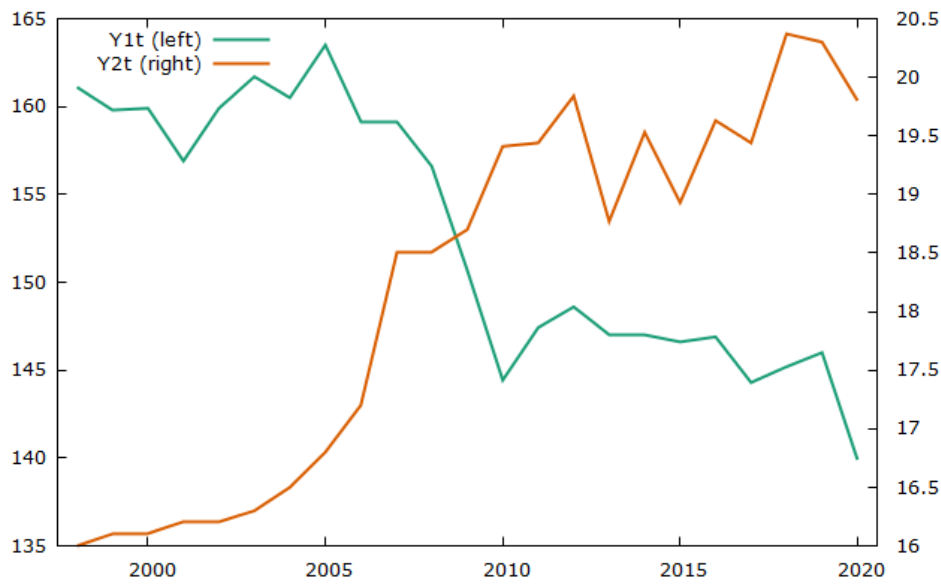


Figure 7 Consumption of beer Vs. white wine in the Czech Republic 1998-2020.“(Gretl time series 2022), (Y_1 beer, Y_2 white wine).

Figure 7 shows the difference in consumption during the previous 22 years in the Czech Republic, where the consumption of beer has reached its maximum of 163.5 L/year/capita by the year 2005 and has declined to its minimum of 139.9 L/year/capita by the year 2020, where white wine consumption was increasing during the last 22 years where it was in its minimum during the years 1998 and 1999 by 16.1 L/year/capita and it reached its maximum by the year 2018 by 20.37 L/year/capita and in 2020 it was slightly declined by half liter/year/capita as it was 19.8 L/year/capita.

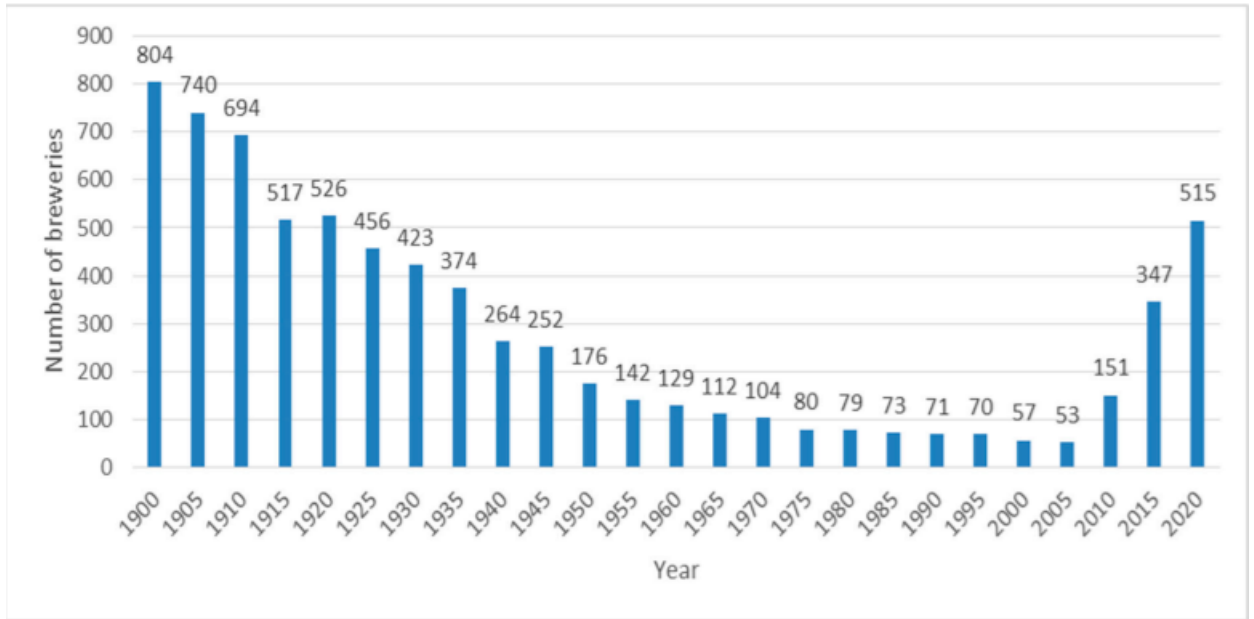


Figure 8 evolution of the number of breweries and craft breweries in Czechoslovakia and the Czech Republic.“(Březinová 2021)

Figure 8 shows the evolution of the number of breweries and craft breweries in Czechoslovakia and the Czech Republic for the last 30 years (Czechoslovakia was divided into the Czech Republic and Slovakia in 1992).

Among the other reasons for low beer consumption is the above a healthier lifestyle for many Czechs who tend to prefer non-alcoholic beverages over alcoholic beverages, and the changing preferences of alcohol consumers as some substitute beer with wine.

Even consumer behavior is changing, in 2003, Czech consumers drank half of the total consumption in bars and restaurants and the other half at home. In 2019, 66% of total consumption was at home (outside trade) and only 34% of consumption was in restaurants and bars (commercial). The main reason is the difference in the price of beer and bottled beer as a result of increased labor and other restaurant costs.“(Statistika a My 2020).

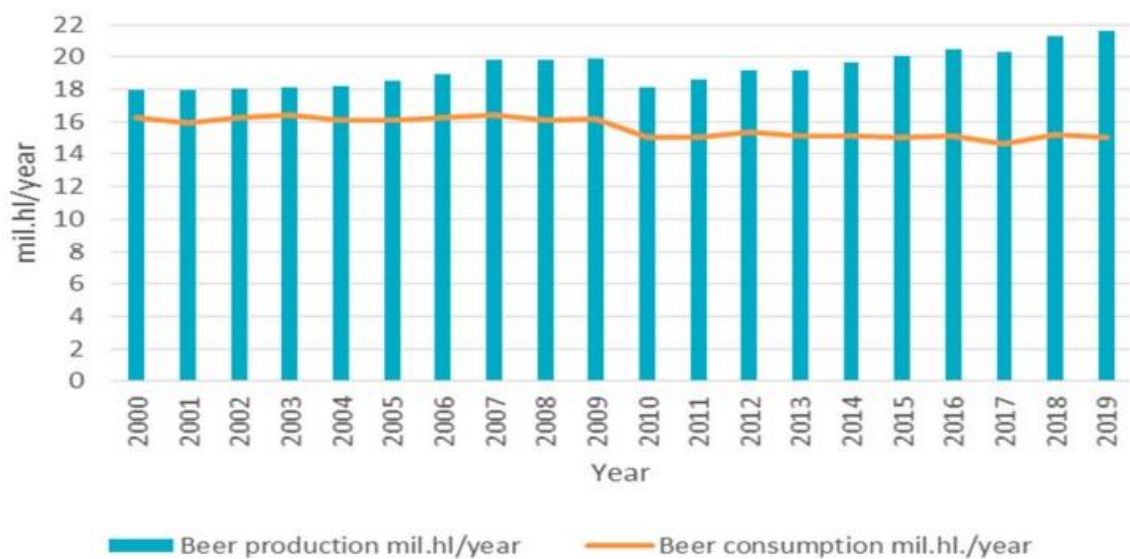


Figure 9 Development of beer production and consumption in the Czech Republic in 2000–2019. “(Monika Březinová 2021)

The Czech Republic has been a long-term beer exporting country, with beer consumption being lower than production volume. In 2019, the Czech Republic exported 5.4 million hectoliters of beer, continuing an upward trend. Slovakia has the largest share of Czech beer exports, with over 1.3 million hectoliters shipped there in 2019. Then came Germany with 1 million hectoliters, followed by Poland, the Russian Federation, and Hungary with around 400,000 hectoliters. Beer imports into the Czech Republic are negligible. In 2019, only 471,000 hectoliters were imported into the Czech Republic, accounting for approximately 2% of total production volume. Beers imported into the Czech Republic are mostly special type beers and beers with a higher degree of alcohol.“(Kamil Picha et. al 2017).

4.2. Determinants of Beer and White Wine

The use of goods and services to satisfy human desires is referred to as consumption. According to Marshall, it is the process by which human desires are satisfied, and consumption is the object of production according to Adam Smith.

A commodity is produced simply because consumers want it. To put it another way, producers create goods and services for them to be consumed. Some commodities, such as apples, are only consumed once. Other commodities, such as a chair or a car, are enjoyed for an extended period. Durable goods are the latter type of goods.

Consumption is influenced by a variety of factors. Consumption is determined by the broad factors that determine the demand for a commodity, such as income, buyer taste and preference, prices of different commodities, including substitutes and complements, period under consideration, income distribution pattern, and so on.

4.2.1 Engel's Law of Consumption

The most famous is the statistical study of the law of consumption by the German statistician Ernst Engel. The following key points about consumption were revealed by this study. These points are commonly referred to as Engel's Law. “(Zimmerman, 1932)“.

1. The greater a person's income, the greater the proportion of it spent on food. Because poor families have very little income, they spend the majority of their income on food, which is a basic human need.
2. As people's income rises, the proportion of their income spent on food falls. This leads to the conclusion that the income elasticity of food demand is less than one. In other words, food demand is income inelastic. This simply means that people with higher incomes spend proportionately less on food than those with lower incomes.
3. As income rises, so does the percentage spent on luxuries and non-essentials such as recreation. When one's income is low, such spending is almost non-existent.
4. At all income levels, the percentage of income spent on clothing, rent, fuel, and lighting remains roughly constant.

Many subsequent investigations and extensive studies of family budgets have confirmed Engel's conclusions based on his statistical studies. It has been demonstrated that, while different people spend their money in different ways, there is a remarkable similarity in the overall pattern at different times and in different countries.

4.2.2. The Determinants of Beer and White Wine Consumption in This Thesis

As was mentioned above, income plays an important determinant of any consumption, and in this thesis besides average gross income in the Czech Republic, the consumers' prices of beer and white wine were selected as a primary determinant to be influencing the consumption of both beer and white wine.

As known in the markets when the price of a commodity decreases, people tend to buy and consume more of that specific product, and where it will be examined if this increase or decrease is going to affect the consumption and consumer behaviour of beer and white wine or no, and which commodity if influenced more by price is it beer or white wine.

4.2.3. Consumption and Economy

In economics, the relationship between consumer spending and the various factors that influence it is referred to as the consumption function. These factors may include income, wealth, expectations about the level and riskiness of future income or wealth, interest rates, age, education, and family size at the household or family level. The consumption function is also influenced by the consumer's preferences (for example, patience or the willingness to postpone gratification), the consumer's attitude toward risk, and whether the consumer wishes to leave a bequest.

Many questions in macroeconomics and microeconomics rely on the characteristics of consumption functions.

The consumption function in macroeconomic models tracks total aggregate consumption expenditures; for simplicity, it is assumed to be dependent on a basic subset of the factors economists believe are important at the household level.

Consumption expenditure analysis is critical for understanding short-term (business cycle) fluctuations as well as long-run issues such as interest rate levels and capital stock size (the number of buildings, machinery, and other reproducible assets useful in producing goods and services). The consumption function, in theory, provides answers to both short-run and long-run questions.

In the long run, because income that is not consumed is saved, the responsiveness of households to any tax policy (such as those aimed at encouraging aggregate saving and increasing the capital stock) will be determined by the structure of the consumption function, specifically what it says about how saving responds to interest rates. In the short run, the effectiveness of tax cuts or other income-boosting policies (such as those intended to stimulate a slumping economy) will be determined by what the consumption function says about how much the average recipient spends or saves from the extra income.

4.3. Models

4.3.1. Econometric Model of Beer Consumption

The economic model is: $y_{1t} = f(x_{1t}, x_{2t}, x_{3t}, x_{4t})$

The econometric model is: $y_{1t} = \gamma_{11}x_{1t} + \gamma_{12}x_{2t} + \gamma_{13}x_{3t} + \gamma_{14}x_{4t} + \varepsilon_{1t}$

Where the variables consist as following:

Endogenous (dependent) variables:

y_{1t} - beer consumption in the Czech Republic (litter/year/capita).

Exogeneous (independent) variables:

x_{1t} – unit vector. (contains values 1 for each point of the time series).

x_{2t} – consumer price of beer (CZK/ltr) in the Czech Republic.

x_{3t} – consumer price of white wine (CZK/ltr) in the Czech Republic.

x_{4t} – level of income (average gross monthly salary, CZK) in the Czech Republic.

ε_{1t} – error term.

The Assumption of the model is based on the selected variables as the main determinant of the consumption of beer and white wine, as was mentioned previously the consumer price of any good is an important determinant of the consumption of that good in the market and this model, the consumer prices of beer and white wine in the Czech Republic are assumed as a main determinant of the model to be analyzed to see their impact on the consumption for the selected time series.

The other assumption of this model is based on the selection of the average gross income in the Czech Republic for the selected time series, where the average income is considered an important determinant of consumption of any good in the market, in this case, it is assumed as average gross income changes, the consumption of beer and white wine will changes.

- **Time Series**

Table 1 data set

obs	Y1t	X2t	X3t	X4t
1998	161.1	14.4	55.2	11693
1999	159.8	15.2	54.2	12655
2000	159.9	15.2	57.4	13219
2001	156.9	15.6	66.1	14378
2002	159.9	16.8	63.4	15524
2003	161.7	17.2	61.4	16430
2004	160.5	17	62.3	17466
2005	163.5	16.8	59.6	18344
2006	159.1	8.45	56.53	19546
2007	159.1	8.51	55.08	20957
2008	156.6	8.97	54.76	22592
2009	150.68	9.18	56.35	23344
2010	144.43	9.89	57.98	23864
2011	147.42	10.05	62.98	24455
2012	148.6	10.16	64.35	25067
2013	147.02	10.55	66.18	25035
2014	147.01	10.63	71.72	25768
2015	146.61	10.69	77.26	26591
2016	146.9	11.23	82.8	27764
2017	144.3	11.3	88.34	29638
2018	145.19	11.83	93.88	32051
2019	146	11.59	98.82	34605
2020	139.9	11.62	94.13	36107

Source [<https://vdb.czso.cz/vdbvo2/faces/en/index.jsf>,
<https://www.agriculturejournals.cz/publicFiles/00244.pdf>]

- **Correlation Matrix**

To check if the problem of multicollinearity exists, it is necessary to define the correlation matrix. For this, software Gretl is used.

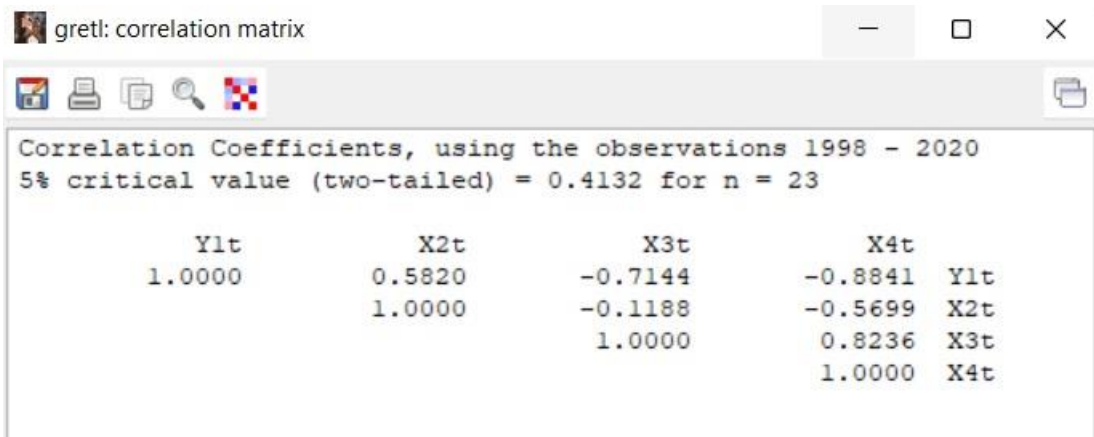


Figure 10 Correlation matrix for the first model

From Figure 10, it's shown that the relationship between exogenous variables is strong. So as it is shown from the coefficients of correlation between the independent variables (-0.5699, 0.8236, -0.1188), where two of them are within the interval [-0.8; 0.8]. So that means, and 0.8236 is > 0.8 which means the problem of multicollinearity exists and it is needed to eliminate before running the model.

To eliminate the problem of multicollinearity the first difference in the average gross income (X_4) will be made using Gretl as is shown in figure 7.

Table 2 first difference of average gross salary

X4t	d_X4t
11693	NA
12655	962
13219	564
14378	1159
15524	1146
16430	906
17466	1036
18344	878
19546	1202
20957	1411
22592	1635
23344	752
23864	520
24455	591
25067	612
25035	-32
25768	733
26591	823
27764	1173
29638	1874
32051	2413
34605	2554
36107	1502

The first difference will be employed to eliminate the problem of multicollinearity for the current model as is shown in the next figure.

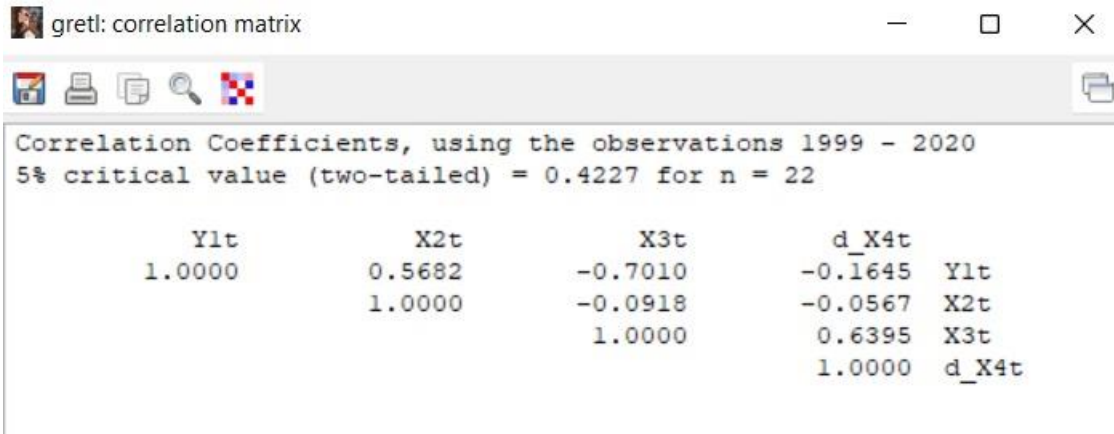


Figure 11, elimination of the problem of multicollinearity

Figure 11 explains the elimination of the problem of multicollinearity, as is shown in the figure, all values of the independent variables (-0.567, 0.6395, -0.0918) belong to the interval (-0.8, 0.8). so the problem of multicollinearity has been eliminated and the model is ready to be analyzed to estimate the parameters as is explained in the next section.

- Parameters Estimation

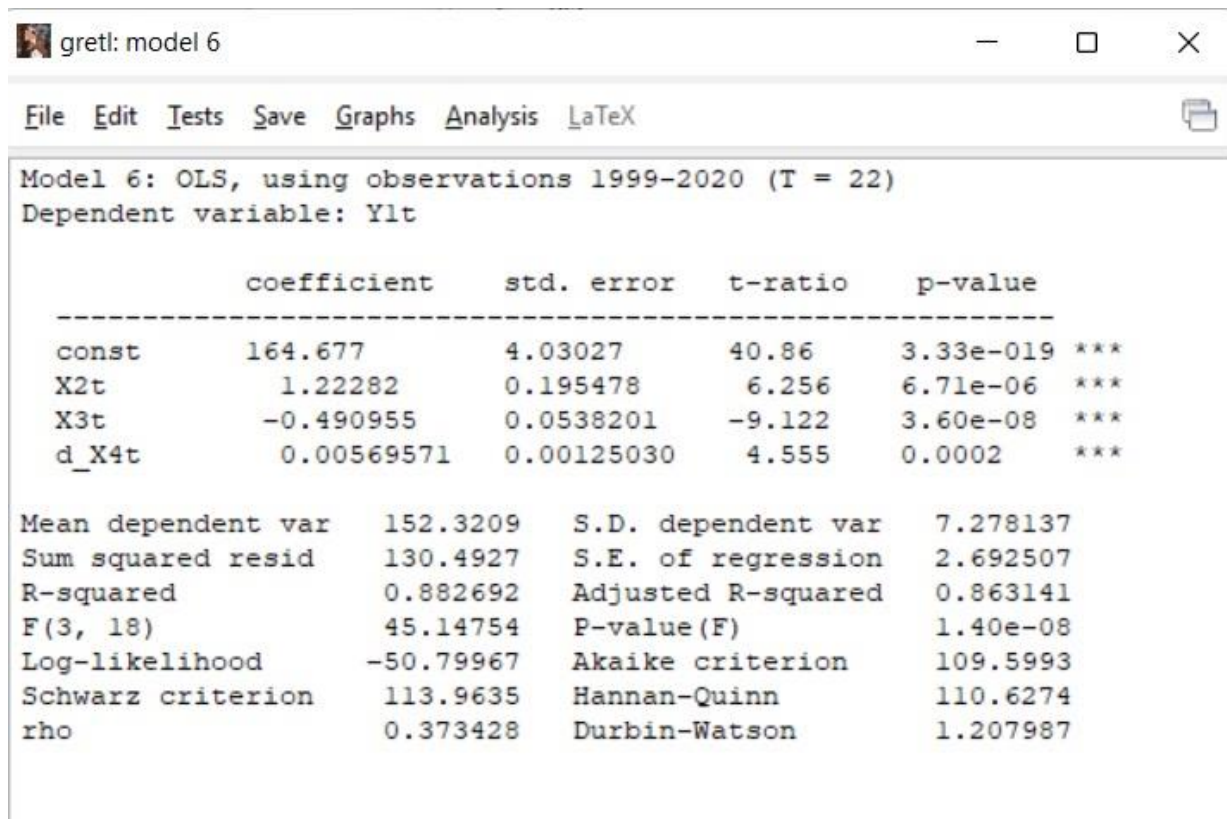


Figure 12 Parameters estimation of the first model

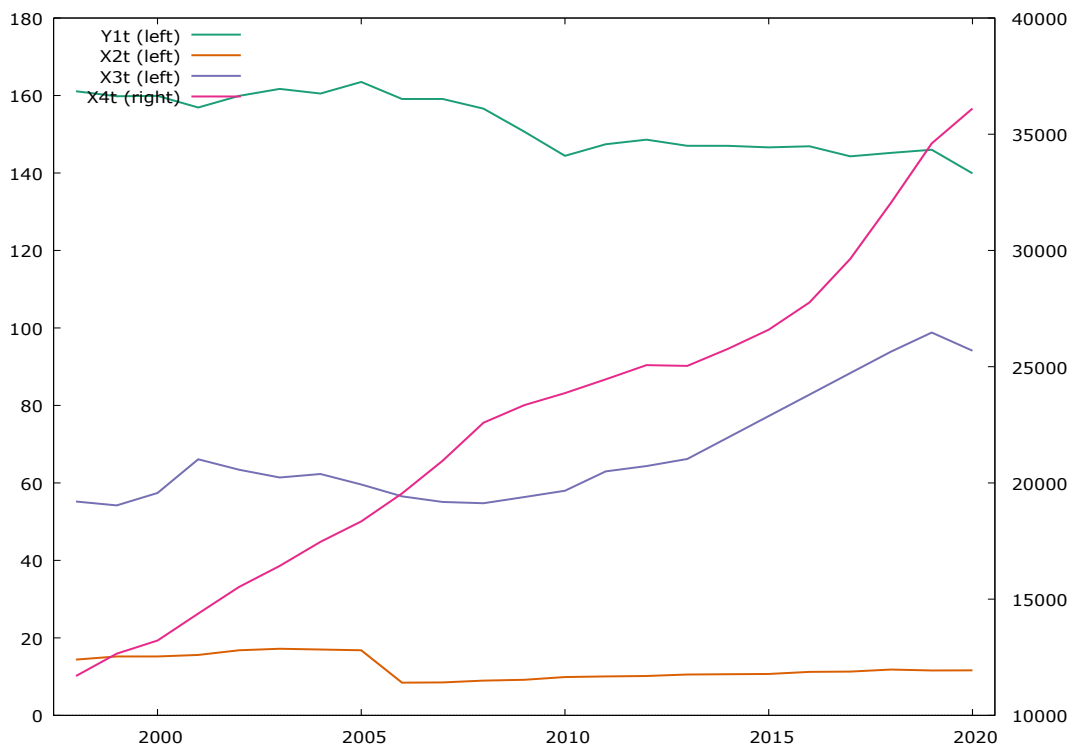


Figure 13 time series of the selected variables with beer consumption

Figure 13 shows the increase of average gross salary in the selected period all over the years, while the consumer price of white wine has a wobbling value, as it was increasing for the first two years of the selected period, then it was decreasing from 2000 to 2008 and it increases again from 2008 to 2018 and it has slightly decreased.

On the other hand consumption of beer was almost decreasing over the selected period, while the consumer price of beer has significantly decreased from the year 2003 and it is increasing slightly from 2003 to 2020.

- **Interpretation of The Estimated Parameters.**

$$y_{1t} = 164.677 + 1.223x_{2t} - 0.491x_{3t} + 0.0057d_{x4t} + \varepsilon_{1t}$$

From Figure 12, in the column ‘coefficient’ it is shown the values of the estimated parameters.

164.677 – is related to X_{1t} (unit vector). So, the value **164.677** represents some initial level of consumption of beer. If the influence of other commodities (consumer prices of beer and white wine, and average gross income) would be omitted, then the consumption of beer would be **164.677** lt/year/capita.

1.223 – is related to the consumer price of beer and represents that if the consumer price of beer increases by one unit (1 CZK/lt), then the consumption of beer increases by **1.223** lt/year/capita. Generally, it is known that the general rule of demand for products (if the product price increases by one unit, its consumption decreases), so technically this should be expected as the parameter would have a negative value. In this case, it is positive, it can be considered the fact that the Czech Republic holds the first place for the consumption of beer per capita in the whole world, because of its cheap price and high quality. It might be concluded that Czech consumers are not very negatively affected by the price changes of beer.

-0.491 – is related to the consumer price of white wine and represents the fact if the consumer price of white wine increases by one unit (1 CZK), then the consumption of beer decreases by **0.491** lt/year/capita. This might explain the fact that beer and white wine are related in terms of consumption, even it does not make sense somehow by realizing the fact of increasing the price of another commodity (white wine in this case), the consumption of

the other commodity decreases, but it can be considered that some consumers change their preference of beer by consuming more white wine

0.0057 – is related to the average gross income which explains that, if the average gross income increases by (1 CZK), the consumption of beer increases by 0.0057 lt/year/capita. Since the value is really small (almost 0), it can be said that beer consumption is not affected by any slight changes in the average gross income.

From the overall results of the model, it can be concluded that the selected variables affect the consumption of beer in the Czech Republic in the selected time series and this effect differs from one variable to another, but the most variable is affecting the consumption process of beer is the beer price, where the maximum change of consumption happens when the consumer price of beer changes, and in this case as mentioned above the consumption of beer increases regarding the change of the consumer price, and it might increase more if the prices going down, which proves the fact of Czech hold the number one consumer of alcohol in the world.

- **Model Verification**

For the statistical verification of the parameters and verification of the quality of the used model, as a result of the software, the P-value.

- Parameters estimation.

The first P-value (corresponding with the intercept) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value $3.33 \cdot 10^{-19}$ which is $< \alpha$ (meaning that the parameter is statistically significant).

The Second P-value (corresponding with the consumer price of beer) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value = $6.71 \cdot 10^{-06}$ which is $< \alpha$ (meaning that the parameter is statistically significant).

The Third P-value (corresponding with the consumer price of white wine) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value = $3.6 \cdot 10^{-08}$ which is $< \alpha$ (meaning that the parameter is statistically significant).

The Forth P-value (corresponding with the average gross income) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value = 0.0002^{which} is $< \alpha$ (meaning that the parameter is statistically significant).

- R^2 / adjusted R-squared.

In the model, the adjusted R-squared is 0.863, so this means approximately 86.3% of the variance in the outcome, variables are explained by the model

- F-test (P-value)

The P-value (F) is $1.4 \cdot 10^{-08}$ which is almost zero, smaller than $\alpha = 0.001$, so it is clear that the model is very good from the statistical viewpoint.

- **Model Application**

For the application of the model, the coefficients of elasticity are going to be used. So by checking the change of the dependent variable (beer consumption in this model) if the explanatory variable (Consumer prices of beer and white wine, and average income) increases by 1%.

$y_i = f(x_i, x_j, x_{in})$ for calculation of the elasticities, the last period 2020 is selected.

The model equation will be used by substituting the independent variables based on the type of elasticity as the following:

$$y_{1t} = 164.677 + 1.223x_{2t} - 0.491x_{3t} + 0.0057d_{x4t}$$

- Direct price elasticity – it shows the relationship of commodity and its consumer price, so by substituting 11.62 in all Xs in the model to find \bar{Y}_i

$$\bar{Y}_i = 164.677 + 1.223(11.62) - 0.491(11.62) + 0.0057(11.62) = 173.25$$

$$e_{ii} = \frac{\partial y_i}{\partial x_i} \times \frac{x_i}{\bar{y}_i} = 1.223 \times \frac{11.62}{173.25} = 0.082$$

If the consumer price of beer increases by 1%, the consumption of beer changes by 0.082%.

- Cross-price elasticity – influences the the the the of price of another commodity and consumption of another commodity, by substituting 94.13 in all Xs in the model to find \bar{Y}_i

$$\bar{Y}_i = 164.677 + 1.223(94.13) - 0.491(94.13) + 0.0057(94.13) = 234.12$$

$$e_{ij} = \frac{\partial y_i}{\partial x_j} \times \frac{x_j}{\bar{y}_i} = -0.491 \times \frac{94.13}{234.12} = -0.20$$

If the consumer price of white wine increases by 1%, the consumption of beer changes by 0.20%.

- Income elasticity – reflects the change in consumption when average gross income increases by 1%. By substituting 1502 in all Xs in the model to find \bar{Y}_i

$$\bar{Y}_i = 164.677 + 1.223(1502) - 0.491(1502) + 0.0057(1502) = 1272.7$$

$$e_{iin} = \frac{\partial y_i}{\partial x_{in}} \times \frac{x_{in}}{\bar{y}_i} = 0.0057 \times \frac{1502}{1272.7} = 0.0067$$

When income increases by 1%, beer consumption increases by 0.0067% which represents a very low elasticity.

- **Econometric Tests on The Model**

The following tests were used to test the first model:

- Test for normality of residual - Null hypothesis:
error is normally distributed

Test statistic: Chi-square(2) = 0.459373 with p-value = 0.794783

- QLR test for structural break - Null hypothesis: no structural
break

Test statistic: chi-square(4) = 75.7839 at observation 2009
with asymptotic p-value = 2.42008e-014

- CUSUM test for parameter stability- Null hypothesis:
no change in parameters

Test statistic: Harvey-Collier $t(18) = -0.415444$
with p-value = $P(t(18) > -0.415444) = 0.682727$

- Durbin-Watson statistic = 0.70377

p-value = 8.21061e-006

4.3.2. Econometric Model of WW Consumption

The economic model is: $y_{2t} = f(x_{1t}, x_{2t}, x_{3t}, x_{4t})$

The econometric model is: $y_{2t} = \gamma_{11}x_{1t} + \gamma_{12}x_{2t} + \gamma_{13}x_{3t} + \gamma_{14}x_{4t} + \varepsilon_{1t}$

Where the variables consist as following:

Endogenous (dependent) variables:

Y_{2t} - white wine consumption in the Czech Republic (litter/year/capita).

Exogeneous (independent) variables:

x_{1t} – unit vector. (contains values 1 for each point of the time series).

x_{2t} – consumer price of beer (CZK/lt) in the Czech Republic.

x_{3t} – consumer price of white wine (CZK/lt) in the Czech Republic.

x_{4t} – level of income (average gross monthly salary, CZK) in the Czech Republic.

ε_{1t} – error term.

The Assumption of the model is based on the selected variables as the main determinant of the consumption of beer and white wine, as was mentioned previously the consumer price of any good is an important determinant of the consumption of that good in the market and this model, the consumer prices of beer and white wine in the Czech Republic are assumed as a main determinant of the model to be analyzed to see their impact on the consumption for the selected time series.

The other assumption of this model is based on the selection of the average gross income in the Czech Republic for the selected time series, where the average income is considered an important determinant of consumption of any good in the market, in this case, it is assumed as average gross income changes, the consumption of beer and white wine will changes.

- **Time Series**

Table 3 data set

obs	Y2t	X2t	X3t	X4t
1998	16	14.4	55.2	11693
1999	16.1	15.2	54.2	12655
2000	16.1	15.2	57.4	13219
2001	16.2	15.6	66.1	14378
2002	16.2	16.8	63.4	15524
2003	16.3	17.2	61.4	16430
2004	16.5	17	62.3	17466
2005	16.8	16.8	59.6	18344
2006	17.2	8.45	56.53	19546
2007	18.5	8.51	55.08	20957
2008	18.5	8.97	54.76	22592
2009	18.7	9.18	56.35	23344
2010	19.41	9.89	57.98	23864
2011	19.44	10.05	62.98	24455
2012	19.84	10.16	64.35	25067
2013	18.77	10.55	66.18	25035
2014	19.53	10.63	71.72	25768
2015	18.93	10.69	77.26	26591
2016	19.63	11.23	82.8	27764
2017	19.44	11.3	88.34	29638
2018	20.37	11.83	93.88	32051
2019	20.3	11.59	98.82	34605
2020	19.8	11.62	94.13	36107

Source[<https://vdb.czso.cz/vdbvo2/faces/en/index.jsf>,

<https://www.agriculturejournals.cz/publicFiles/00244.pdf>

- **Correlation Matrix**

To check if the problem of multicollinearity exists, it is necessary to define the correlation matrix. For this, software Gretl is used. As mentioned previously, the problem of multicollinearity exists.

To eliminate the problem of multicollinearity in this model the first difference in the Consumer price of white wine (X_3) will be made using Gretl.

Tabulka 4 the first difference of WW consumer price

X3t	d_X3t
55.2	NA
54.2	-1
57.4	3.2
66.1	8.7
63.4	-2.7
61.4	-2
62.3	0.9
59.6	-2.7
56.53	-3.07
55.08	-1.45
54.76	-0.32
56.35	1.59
57.98	1.63
62.98	5
64.35	1.37
66.18	1.83
71.72	5.54
77.26	5.54
82.8	5.54
88.34	5.54
93.88	5.54
98.82	4.94
94.13	-4.69

Attachment 4 shows the first difference which will be employed to eliminate the problem of multicollinearity for the current model as is shown in the next figure.

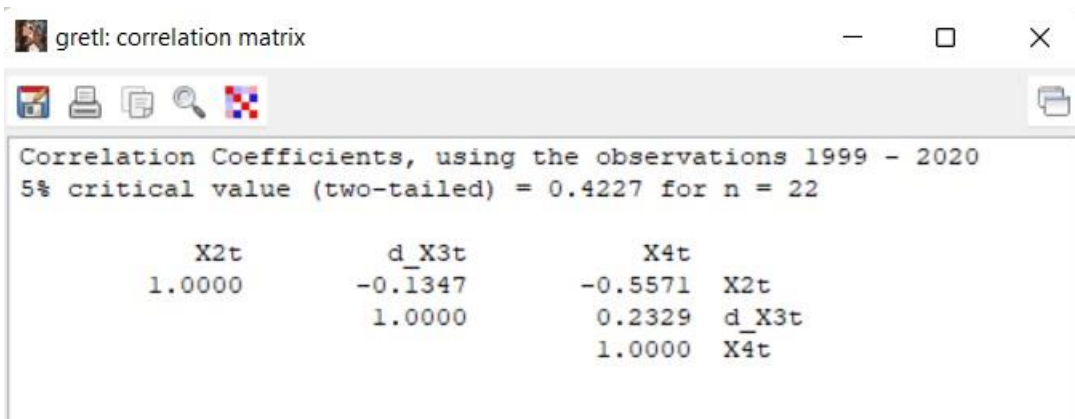


Figure 14, elimination of multicollinearity

Figure 14 explains the elimination of the problem of multicollinearity, as is shown in the figure, all values of the independent variables (-0.5571, -0.1347, 0.2329) belong to the interval (-0.8, 0.8). so the problem of multicollinearity has been eliminated and the model is ready to be analyzed to estimate the parameters as is explained in the next section.

- **Parameters Estimation**

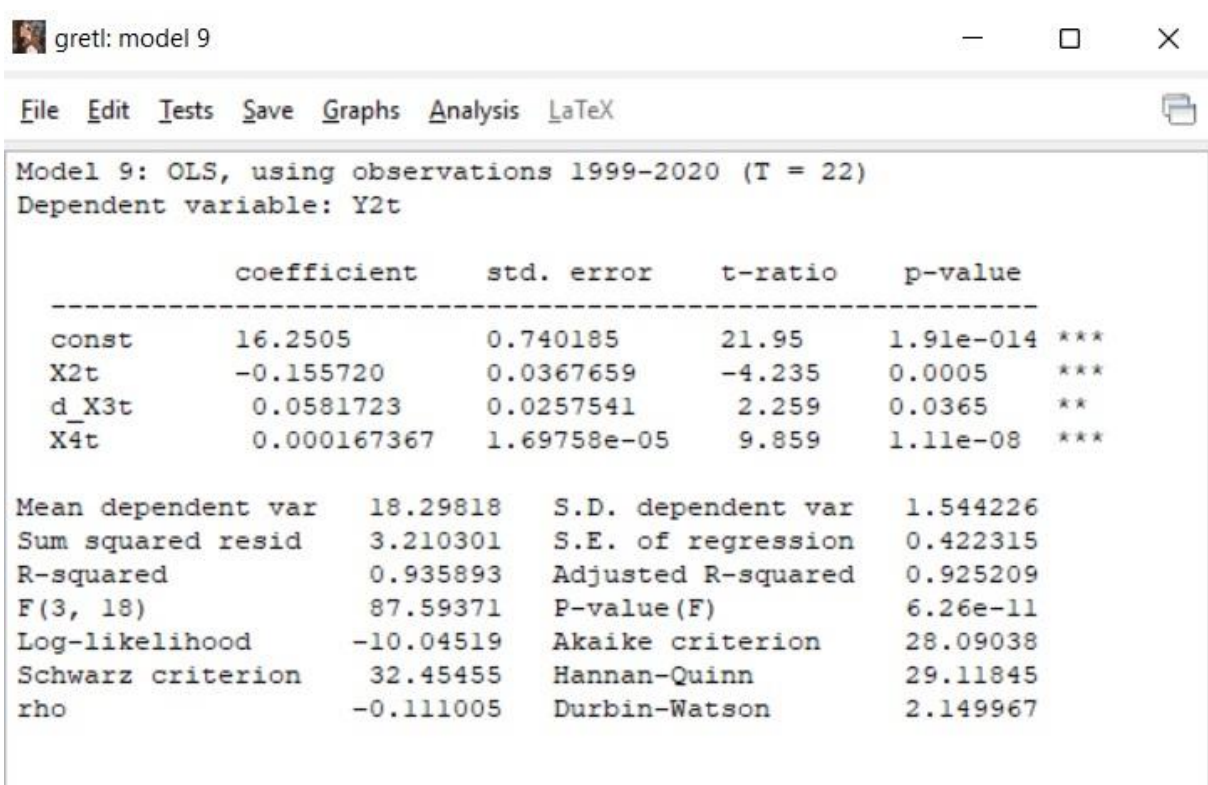


Figure 15 Parameters Estimation

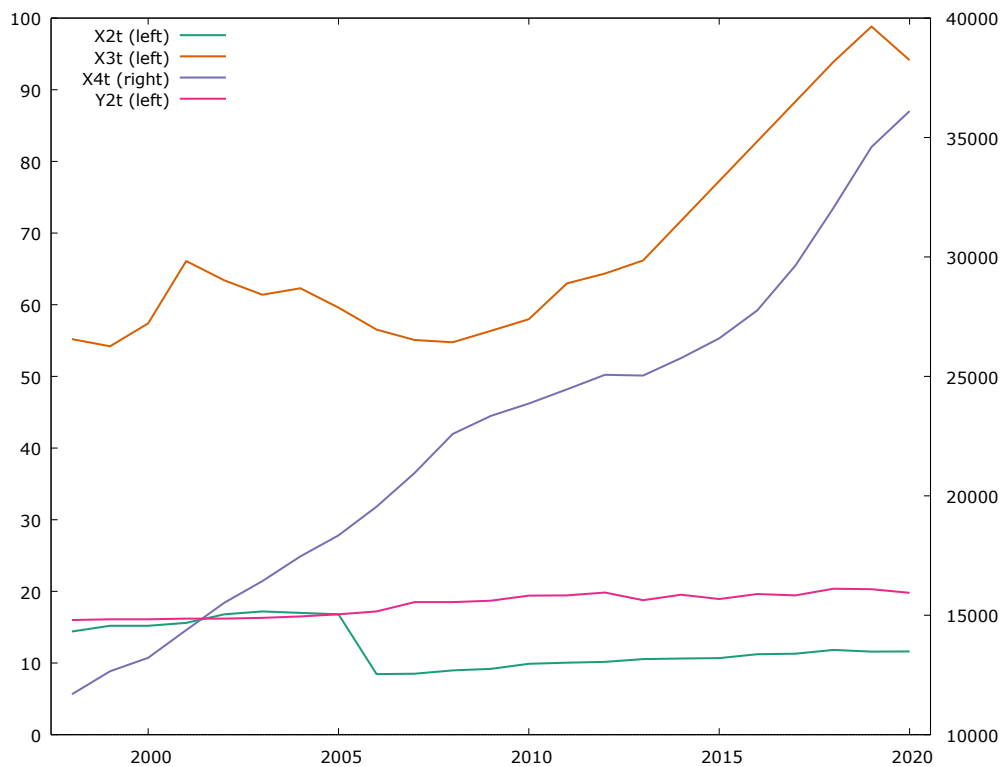


Figure 16 time series of the selected variables and WW consumption

Figure 16 shows the time series of the selected variables which were explained previously in figure 14 and the consumption of white wine.

The consumption of white wine has increased continuously in the selected period as shown in the figure in the Y2t plot.

- **Interpretation of Estimated Parameters.**

$$Y_{2t} = 16.2505 - 0.15572x_{2t} + 0.0582d_{-}x_{3t} + 0.00017x_{4t} + \epsilon_{1t}$$

In figure 15, the column ‘coefficient‘ shows the values of the estimated parameters of white wine consumption and is explained as the following:

16.2505 – is related to X_{1t} (unit vector). So, the value **16.2505** represents some initial level of consumption of white wine. If the influence of other variables (the consumer prices of beer and white wine, and the average gross income) would be omitted, then the consumption of white wine would be **16.2505** lt/year/capita.

- **0.15572**– is related to the consumer price of beer. If the consumer price of beer increases by one unit (1 CZK/l), then the consumption of white wine decreases by **0.15572** lt/year/capita. It explains the fact that the price of beer is influencing the consumption of white wine, whereby increasing the price of beer, consumers tend to consume more beer, which does not make sense logically talking in normal life, but it might be considered as some people change their preferences to consume beer instead of white wine.

0.0582 – related to the consumer price of white wine. If the consumer price of white wine increases by one unit (1 CZK), then the consumption of white wine decreases by 0.0582 lt/year/capita. Generally, it is known that the general rule of demand for products (if the product price increases by one unit, its consumption decreases), so technically this should be expected as the parameter would have a negative value. In this case, it is positive can be considered the fact that the Czech Republic holds the first place for the consumption of alcohol which part of it is white wine per capita in the whole world, because of its relatively cheap prices. It might be concluded that Czech consumers are not very negatively affected by the price changes of white wine as the consumption is increasing both ways.

0.00017– if the average income increases by 1CZK, the consumption of white wine increases by 0.00017 lt/year/capita. Since the value is really small (almost 0), it can be said that white wine consumption is not affected by any slight changes in income.

From the overall results of the model, it can be concluded that the selected variables affect the consumption of white wine in the Czech Republic in the selected time series and this effect differs from one variable to another, but the most variable is influencing the consumption process of white wine is the beer price, where the maximum change of white wine consumption happens when the consumer price of beer changes.

Model Verification

For the statistical verification of the parameters and verification of the quality of the used model, as a result of the software, the P-value.

- Parameters estimation.

The first P-value (corresponding with the intercept) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value = $1.91 \cdot 10^{-14}$ which is $< \alpha$ (meaning that the parameter is statistically significant).

The Second P-value (corresponding with the consumer price of beer) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value = 0.0005 which is $< \alpha$ (meaning that the parameter is statistically significant).

The Third P-value (corresponding with the consumer price of white wine) has only 1 star, which means that for the selected level of significance $\alpha = 0.001$, the P-value = 0.0365 $> \alpha$ (meaning that the parameter is statistically insignificant).

The Fourth P-value (corresponding with the average gross income) has 3 stars, which means that for the selected level of significance $\alpha = 0.001$, the P-value = $1.11 \cdot 10^{-08}$ which is $< \alpha$ (meaning that the parameter is statistically significant).

- R^2 / adjusted R-squared.

In the model, the adjusted R-squared is 0.925, so this means approximately 92.5% of the variance in the outcome, variables are explained by the model.

- F-test (P-value)

The P-value (F) is $6.26 \cdot 10^{-14}$, which is almost zero, and smaller than $\alpha = 0.001$, so it is clear that the model is good from the statistical viewpoint.

- **Model Application**

For the application of the model, the coefficients of elasticity are going to be used. So by checking the change of the dependent variable (beer consumption in this model) if the explanatory variable (Consumer prices of beer and white wine, and average income) increases by 1%.

$y_i = f(x_i, x_j, x_{in})$ for calculation of the elasticities, the last period 2020 is selected.

The model equation will be used by substituting the independent variables based on the type of the elasticity as the following:

$$Y_{2t} = 16.2505 - 0.15572x_{2t} + 0.0582d_{-x_{3t}} + 0.00017x_{4t} + \epsilon_{1t}$$

- Direct price elasticity – it shows the relationship of commodity and its consumer price, so by substituting -4.69 in all Xs in the model to find $\bar{Y}_i = 16.2505 - 0.15572(-4.69) + 0.0582(-4.69) + 0.00017(-4.69) = 16.71$

$$e_{ii} = \frac{\partial y_i}{\partial x_i} \times \frac{x_j}{\bar{y}_i} = 0.0582 \times \frac{-4.69}{7.09} = -0.01634$$

If the consumer price of white wine increases by 1%, the consumption of white wine decreases by 0.01634%, meaning in this case the price of white wine is a strong factor that influences the consumption of white wine, whereas if the price increases, the consumption increases.

- Cross-price elasticity – the influence the the the the the of price of another commodity and consumption of another commodity, by substituting 11.62 in all Xs in the model to find \bar{Y}_i

$$\bar{Y}_i = 16.2505 - 0.15572(11.62) + 0.0582(11.62) + 0.00017(11.62) = 15.12$$

$$e_{ij} = \frac{\partial y_i}{\partial x_j} \times \frac{x_i}{\bar{y}_i} = 0.0582 \times \frac{11.62}{15.12} = 0.04473$$

If the consumer price of beer increases by 1%, the consumption of white wine changes by 0.04473%.

- Income elasticity – reflects the change in consumption when average gross income increases by 1%. By substituting 36107 in all Xs in the model to find \bar{Y}_i

- $\bar{Y}_i = 16.2505 - 0.15572(36107) + 0.0582(36107) + 0.00017(36107) = -3498.77$

$$e_{iin} = \frac{\partial y_i}{\partial x_{in}} \times \frac{x_{in}}{\bar{y}_i} = 0.00017 \times \frac{36107}{-3498.77} = -0.00175$$

When average gross income increases by 1%, white wine consumption changes by 0.00175%. Very low elasticity.

- **Econometric Tests on Model**

The following tests were used to test the second model:

- Test for normality of residual - Null hypothesis: error is normally distributed

Test statistic: Chi-square(2) = 1.61074 with p-value = 0.446922

- QLR test for structural break -

Null hypothesis: no structural break

Test statistic: $\chi^2(4) = 14.1295$ at observation 2007
with asymptotic p-value = 0.102987

- CUSUM test for parameter stability -

Null hypothesis: no change in parameters

Test statistic: Harvey-Collier $t(17) = -0.456411$
with p-value = $P(t(17) > -0.456411) = 0.653872$

- Durbin-Watson statistic = 2.14997

p-value = 0.417943

5. Conclusion and Recommendations

Consumption is an important topic to be focused on, as it is the main thing in daily life, and the determinants of consumption in this thesis explained the fact that consumption is influenced in different ways, where the determinants of consumption processes of beer and white wine, have a significant impact on the consumption processes for the selected time series.

The Czech Republic holds number one worldwide in terms of alcoholic consumption, and the thesis proved that from the results of the practical part, even when the consumer prices _beer and white wine_ increase that doesn't affect the consumption as it is increasing both ways in term of price change.

The trend of beer consumption is decreasing generally, and it has a significant decline during the last year of the selected period, where it has declined from **161** in 1998 to **139.9** in 2020 (litters per year per capita) where it is the lowest consumption in the selected period, and the reason might be due to the current Covid pandemic, as all bars, clubs, and restaurants were partially closed for couple months, and that affects the consumption process.

The trend of white wine consumption is increasing, where it has a significant increase from **16** in 1998-to **20.37** in 2018 (litters per year per capita), but it has declined slightly in the last year of the selected period where it reached **19.8** litters per year per capita in 2020, and that might be due to the same reason of the current Covid pandemic.

The most determinant influence on the consumption of beer and white wine is the consumer price of beer, as the maximum change of beer consumption as concluded from the first model was when the consumer price of beer increased, and it is the same thing with the consumption of white wine, if consumer price of beer increases by one unit (1 CZK/l), then the consumption of beer increases by **1.223** lt/year/capita, and the consumption of white wine decreases by **0.15572** lt/year/capita.

Consumer behaviour is influenced by several factors that differ from one consumer to another, where those factors can be Psychological, Personality, Personal Choice, Drinking History, Genetic, Familial, Environmental, Religious, Social And Cultural, Age, and Educational Factors.

To reduce the consumption of beer and white wine in the Czech Republic of being harmful the change in the price of beer and white wine does not have even a slight impact on consumption, so it is recommended to extend the age of drinking up to 18 years and to prohibit drinking in public by charging people who drink in public

Linearizing the trend function of the consumer price of white wine will give more accurate results as the perfect regression of the data is polynomial, thus linearization is recommended to get more sufficient results.

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7. List of Figures and Observations

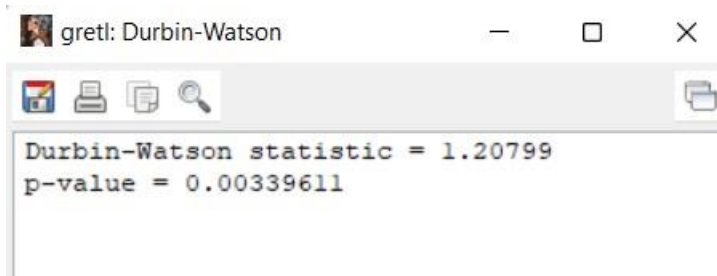
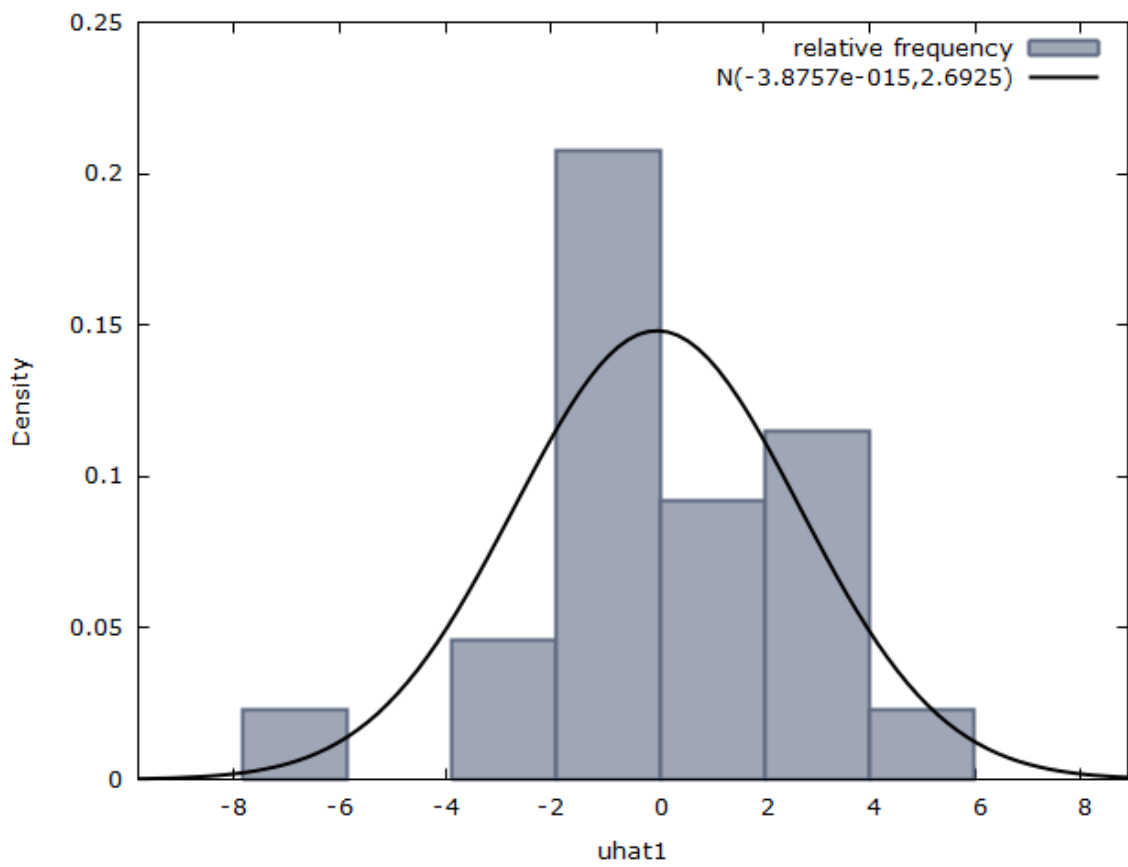
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Appendix





CUSUM test for stability of parameters

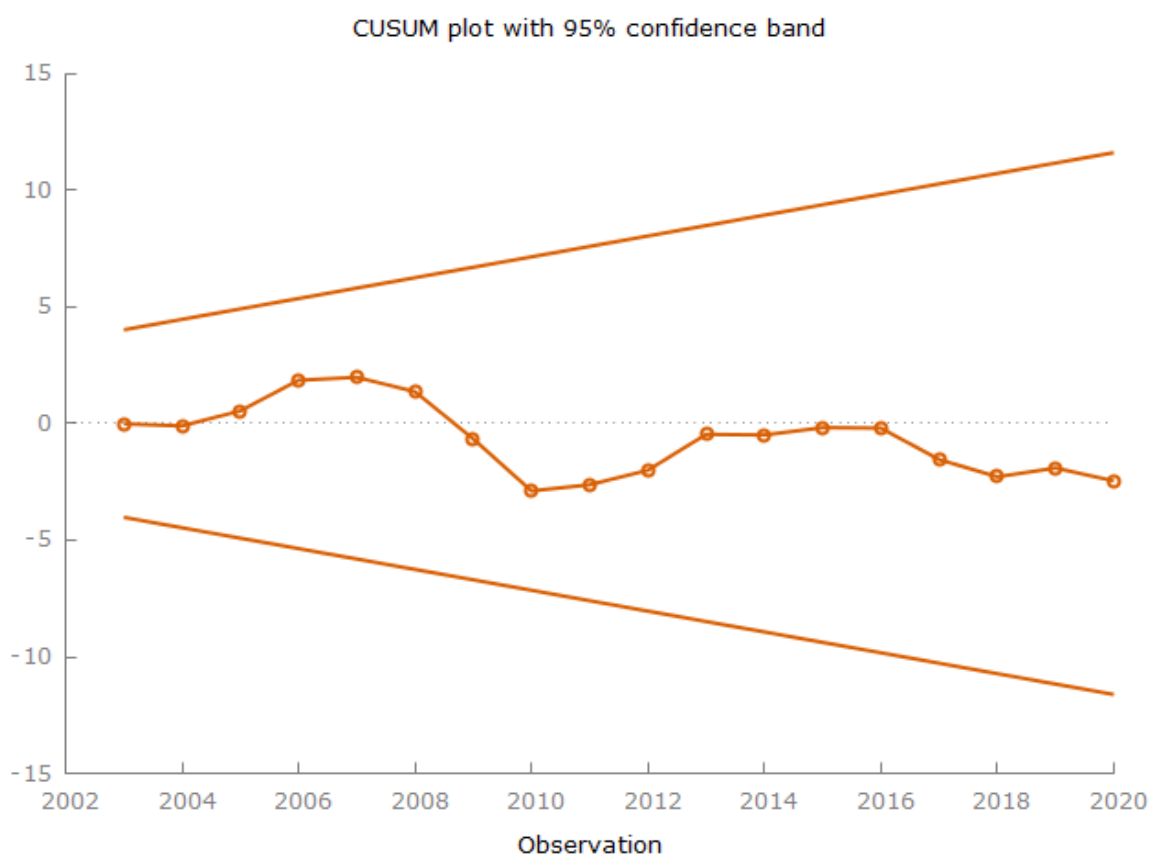
mean of scaled residuals = -0.374687
sigmahat = 2.74361

Cumulated sum of scaled residuals

('*' indicates a value outside of 95% confidence band)

2003	-0.011
2004	-0.101
2005	0.539
2006	1.858
2007	1.984
2008	1.364
2009	-0.661
2010	-2.887
2011	-2.627
2012	-2.002
2013	-0.465
2014	-0.490
2015	-0.177
2016	-0.196
2017	-1.545
2018	-2.282
2019	-1.910
2020	-2.458

Harvey-Collier $t(17) = -0.579406$ with p-value 0.5699

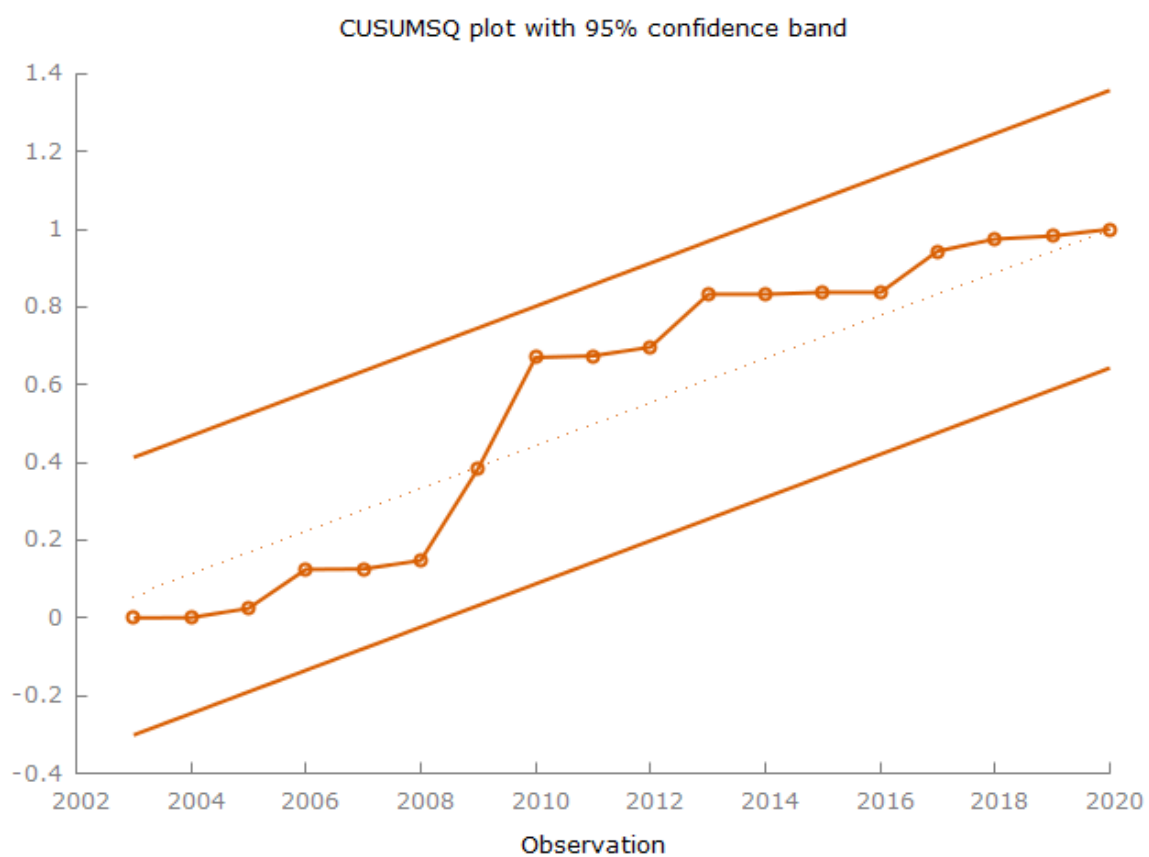


gretl: CUSUMSQ test output

CUSUMSQ test for stability of parameters

Cumulated sum of squared residuals
 ('*' indicates a value outside of 95% confidence band)

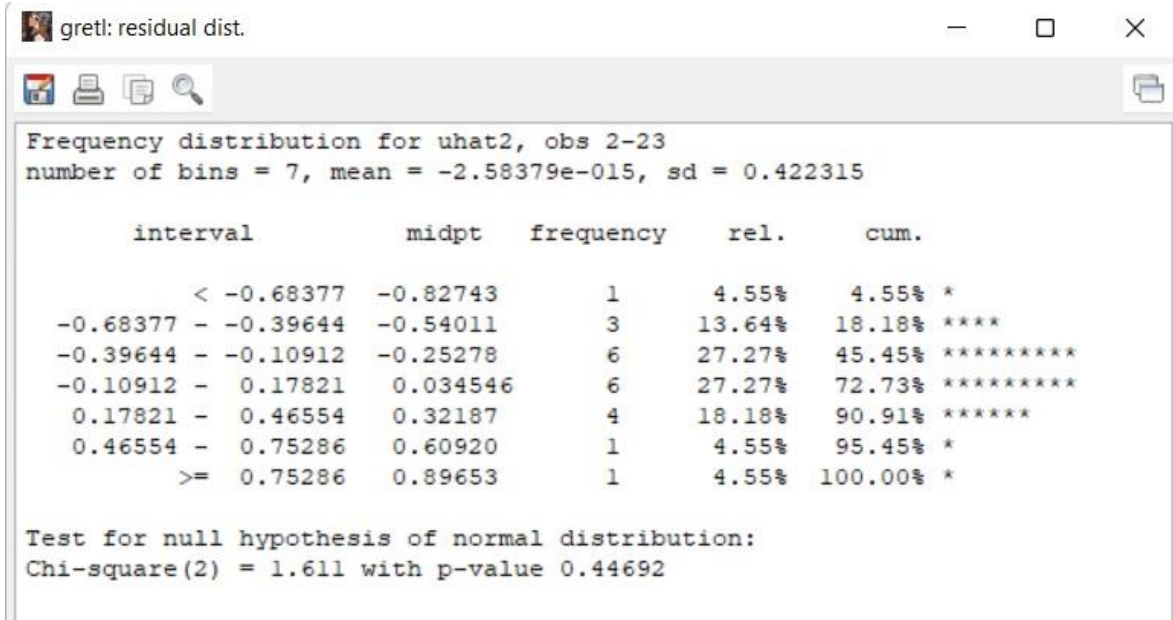
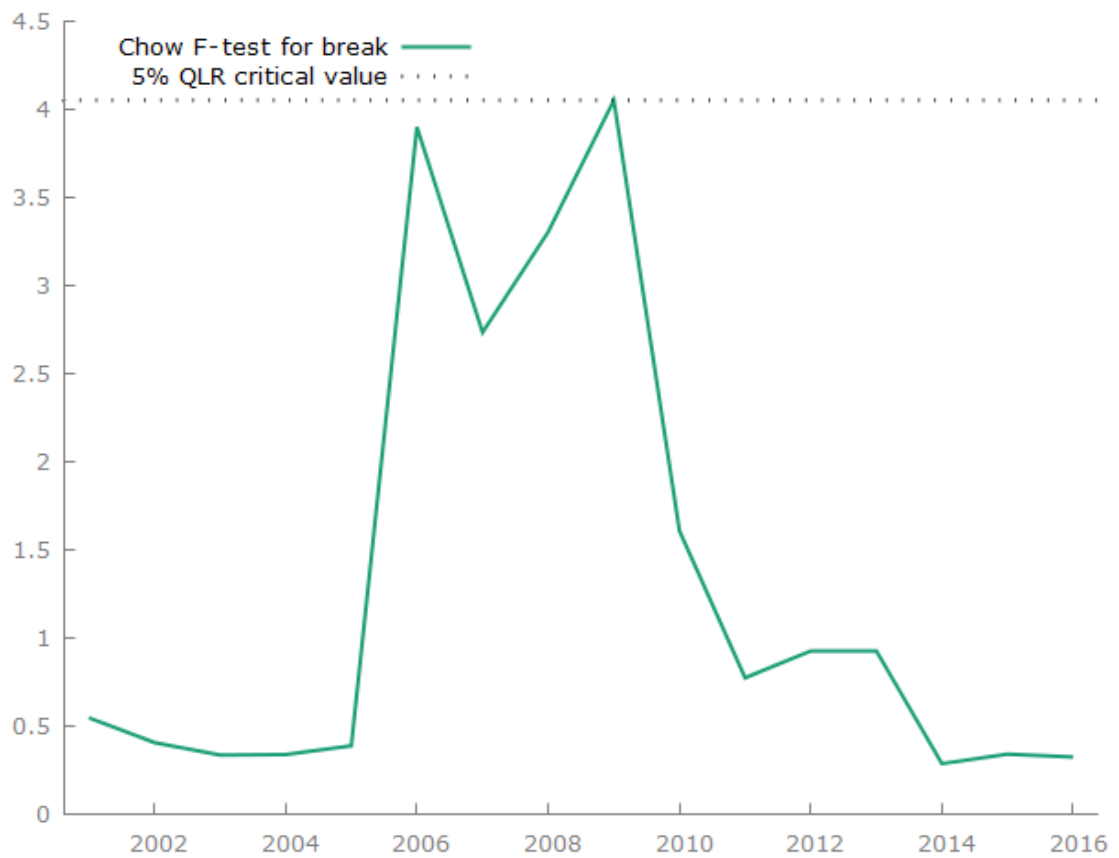
2003	0.000
2004	0.000
2005	0.024
2006	0.125
2007	0.125
2008	0.148
2009	0.384
2010	0.670
2011	0.674
2012	0.696
2013	0.833
2014	0.833
2015	0.838
2016	0.838
2017	0.943
2018	0.975
2019	0.983
2020	1.000

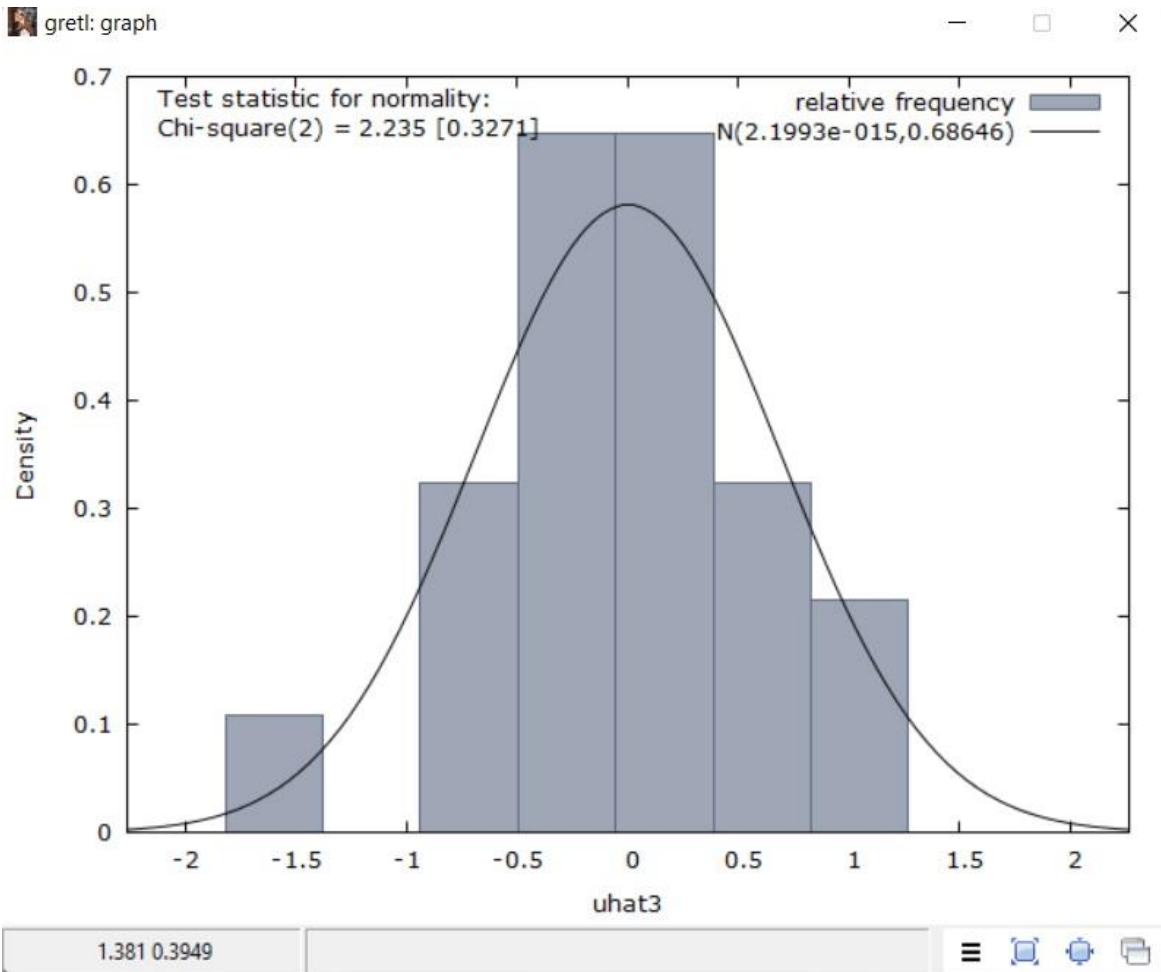


```

gretl: QLR test output
Quantl likelihood ratio test for structural break at an unknown point,
with 15 percent trimming:
The maximum F(4, 14) = 4.0509 occurs at observation 2009
Asymptotic p-value = 0.0489959 for chi-square(4) = 16.2036

```



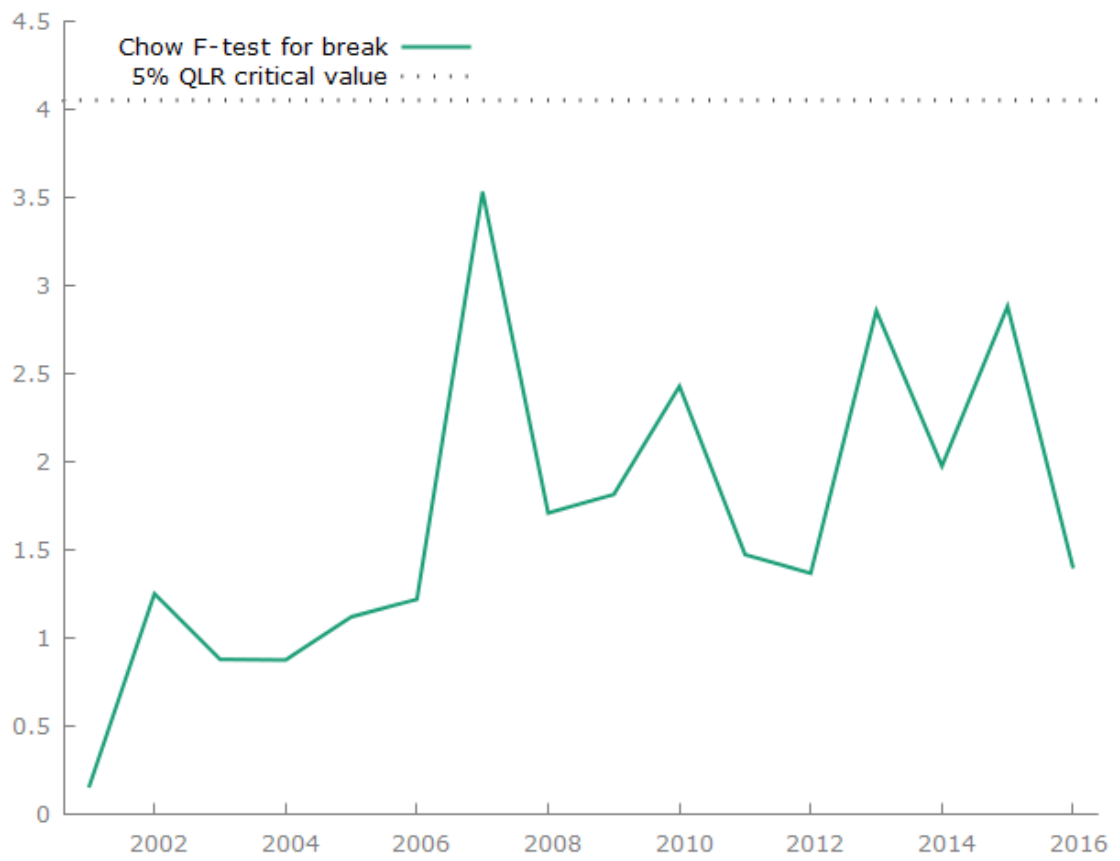


gret: Durbin-Watson

Durbin-Watson statistic = 2.14997
p-value = 0.417943

gret: QLR test output

Quandt likelihood ratio test for structural break at an unknown point,
with 15 percent trimming:
The maximum $F(4, 14) = 3.53238$ occurs at observation 2007
Asymptotic p-value = 0.102987 for chi-square(4) = 14.1295



gretl: CUSUM test output

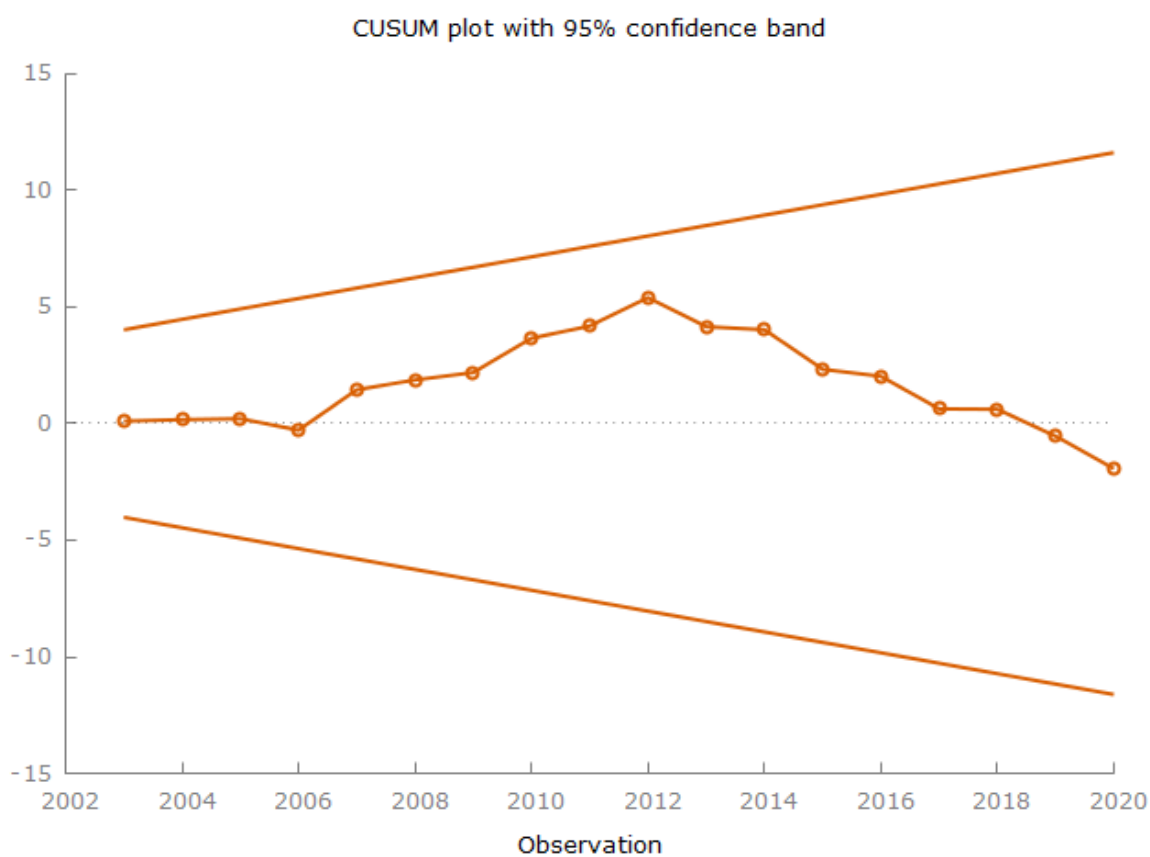
```
CUSUM test for stability of parameters

mean of scaled residuals = -0.0464647
sigmahat                 = 0.43192

Cumulated sum of scaled residuals
('*' indicates a value outside of 95% confidence band)

2003    0.104
2004    0.166
2005    0.207
2006   -0.284
2007    1.447
2008    1.871
2009    2.188
2010    3.658
2011    4.182
2012    5.397
2013    4.157
2014    4.027
2015    2.328
2016    2.029
2017    0.628
2018    0.610
2019   -0.543
2020   -1.936

Harvey-Collier t(17) = -0.456411 with p-value 0.6539
```



gretl: CUSUMSQ test output

CUSUMSQ test for stability of parameters

Cumulated sum of squared residuals
 ('*' indicates a value outside of 95% confidence band)

2003	0.001
2004	0.001
2005	0.001
2006	0.015
2007	0.189
2008	0.200
2009	0.205
2010	0.331
2011	0.347
2012	0.433
2013	0.522
2014	0.523
2015	0.691
2016	0.696
2017	0.810
2018	0.810
2019	0.887
2020	1.000

CUSUMSQ plot with 95% confidence band

